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Contents

EDITORIAL

This third issue of *Phelsuma* reflects an increase in the range of activities undertaken by the Nature Protection Trust of Seychelles and a growing variety in the coverage of *Phelsuma*. The papers published this year show a bias towards invertebrates, it is to be hoped that this represents a long-term increase in the attention given to groups that have been much overlooked in the last few decades.

In addition to slight changes in format this issue sees an important alteration. All papers and notes include both authorities and dates of publication for all Latin names of plants and animals. In some cases this can make sentences awkward but the consistent useage of the full species names is a useful means of ensuring that the identity of the species being discussed is clear, this is of particular importance for invertebrates where the taxonomy is still very unstable. The increase in the number of short articles in the Notes section of this issue is an important development in reporting on the biology of the region, these include a number of significant new records and discussions of recent observations or overlooked records.

CHAIRMAN'S REPORT

The Nature Protection Trust of Seychelles has in the past year continued to strengthen its position as the only non-governmental, non-profit-making conservation body in Seychelles. We have continued our own fund raising programme to finance the activities of the Trust. This includes our sponsor membership scheme, an overseas subscription scheme for our publications and appeals for private donations in response to a recently produced leaflet. We have appealed to the Ministry of Finance to allow us the same incentive of tax relief against company donations to the Trust as allowed to the government's own Environment Trust Fund.

We would like to thank the following companies for their support in 1994:

Air Seychelles
Barclays Bank Plc.
Cousine Island Co.
Seychelles Petroleum Co.
Seychelles Breweries

The continued support of SeyBrew by their sponsorship in publishing our quarterly *Birdwatch* magazine and the invaluable use of their telefax machine and photocopier is very much appreciated.

Our representation on the board of Trustees of the Seychelles Islands Foundation has we hope contributed to a more dynamic image of the SIF being perceived by the overseas trustees. At the end of 1994 I was asked to oversee the contract for the rehabilitation of the research facilities on Aldabra. The procedures are fairly complicated as we are dealing with the World Bank and it is intended that the successful completion of the contract will reflect well on the capabilities of the NPTS.

Of greater direct importance to the NPTS is the opportunity to take on the management of the conservation of Silhouette island. The director of the Islands Development Company, Mr. G. Savy, has agreed that the NPTS undertake this important task and has drawn up a peppercorn lease for the land for a research station at La Passe. Discussions were also held with the Director General of the Department of the Environment, the Conservation Department and Forestry Department. The Silhouette preliminary management plan was circulated at the meeting and was well received as it incorporates most of the current conservation ideas adopted by the DoE. We also met the authors of the new Seychelles Forest Management Plan which is also in line with our own proposals for Silhouette.

The successful outcome of these discussions augres well for the Silhouette project. Our main concern now is to raise funds for the building we have designed as a research station and office at ground level with two bedroomed accommodation for the management staff above. In September I was fortunate to renew my acquaintance with Dr. John Ledger of the Endangered Wildlife Trust of South Africa. The outcome of our meeting was that the Endangered Wildlife Trust would assist the NPTS to raise funds for the research station building.

CHAIRMAN'S REPORT

Scientific work undertaken by the NPTS and its members is covered in detail in this issue of *Phelsuma*. It also carries the annual report on the Roche Caiman Bird Sanctuary which continues to flourish. We look forward to 1995 being a year full of promise for the Trust, its members and supporters.

ROCHE CAIMAN BIRD SANCTUARY - 1994

1). Mud sampling

On 7/7/94 a small study of mud-inhabiting invertebrates was undertaken by placing 0.2m^2 of mud (scraped from the surface to a depth of 2.5cm) in a Tullgren funnel. This extracted 1 Diptera and 6 Acari, giving a density of 5 flies and 30 mites per square metre. In additional small numbers of homopteran bugs were observed on the underside of flakes of mud and algal mat. Birds were seen to feed over the mud and under the flakes on rainy days when flies and bugs were seen to be active.

2). Vegetation surveys

Plants recorded:

Only species recorded or identified for the first time in 1994 are listed below.

		Planted	Colonised <1993	1994
Meliaceae	*Xylocarpus moluuccensis*	+	.	.
Leguminosae	*Delonix regia*	.	.	+
Cyperaceae	*Cyperus alopecuroides*	.	+	.
Graminae	*Panicum maximum*	.	.	+
	Paspalidium geminatum	.	.	+

The planting of *X. moluccensis* (Lamarck, 1783) has experienced considerable problems previously, due to seed and seedling predation by crabs. In 1994 seedlings over 40cm tall were planted out, these do not seem to be attacked by crabs. In December construction of a road drain into the bird sanctuary resulted in considerable damage to the fence and to one corner of the sanctuary, unfortunately this damage included the desctruction of the two *Rothmannia annae* (Wright, 1871) plants.

3). Invertebrates

3a). Crustacea

One species of isopod is found in the bird sanctuary, this is the common western Indian Ocean species *Aphloscia annulicornis* (Budde-Lund, 1885)

3b). Arachnida

For the second consecutive year a collection of spiders from the Bird Sanctuary was identified by Dr. M. Saaristo of Turku University, Finland. New records for the sanctuary were:

Theridiidae	*Coelosoma floridana* Banks, 1900
	Ischnothyreus sp.
Oonopidae	unidentified sp.
Linyphiidae	*"Theonina" tricaudata* Locket, 1982
Salticidae	*Sadies seychellensis* Wanless, 1984
	Plexippus paykulli (Savigny & Audouin, 1825)

Heteropodidae *Heteropoda venatoria* (Linnaeus, 1758)

This is the first record of *"Theonina" tricaudata* from Seychelles, it is discussed in full detail by Saaristo (this volume - page 39).

The spiders occupying *Nephila inaurata* (Walckenaer, 1841) webs were counted in July 1994. 35 webs were found in the Bird Sanctuary, 18 were studied. These were on average 1.5m above ground and 1.67m long. Most webs were inhabited by a range of species and ages of spiders, with no significant correlation with web size or position. The webs were constructed by adult female *N. inaurata* which were present in all webs, in one case two adult females were present in one web, giving an overal density of 1.06 per web. Subadult females occurred in 50% of webs (0.78 per web, 1.56 per occupied web). Juvenile females occurred in 44% of webs (0.78 per web, 1.75 per occupied web). Males were found in 50% of webs (0.89 per web, 1.78 per occupied web). Juveniles (sex indeterminate) were present in very large numbers in 94% of webs (16.0 per web, 16.94 per occupied web).

Kleptoparasitic species were also present in low numbers; 6 *Argyrodes rostratus* Blackwall, 1877 in 4 webs and 1 *Ariames recurvatus* (Saaristo, 1978). The marginal supporting strands of the webs were used by *Tetragnatha* species; 3 *Tetragnatha marginata* (Thorell, 1890) and 1 *Tetragnatha mandibulata* Walckenaer, 1842. Only one individual of this genus was found in any one web.

3d). Diplopods - millipedes

Two species of millipede have been found in the Bird Sanctuary. *Spirostrophus naresii* (Pocock, 1893) was found alive in *Casuarina* leaf litter in 1994, having been found dead on the exposed mud in 1993. The second species (several were found dead on the mud in December 1993 and January 1994) is *Orthomorpha gracilis* (Koch, 1847).

4). Vertebrates

4a). Amphibians

Tadpoles of the frog *Ptychadena mascariensis* (Dumeril & Bibron, 1834) were found in the main pools on 12/12/93. The water in the pools at this stage was mostly rain-water and hence the salinity was low, suitable for tadpole survival. This species is able to tolerate significant salinity levels and often breeds in brackish water.

4b). Mammals

Dogs were present in the bird sanctuary throughout the year gaining access through repeated damage to the perimiter fence.

ROCHE CAIMAN BIRD SANCTUARY - 1994

4c). Birds

Bird records are summarised below:

Species	J	F	M	A	M	J	J	A	S	O	N	D
Pacific golden plover	3	2	1	2	0	0	0	0	0	0	0	0
Grey plover	5	4	16	4	6	13	11	0	28	0	16	2
Ringed plover	1	2	3	0	0	0	0	0	0	0	0	0
Lesser sandplover	14	1	34	22	9	0	1	0	26	0	1	1
Greater sandplover	1	1	0	0	0	0	0	0	3	0	0	0
Bar-tailed godwit	5	0	4	2	2	3	6	0	5	0	8	0
Whimbrel	61	6	58	43	20	27	25	0	55	0	38	8
Eurasian curlew	2	0	2	1	0	0	0	0	2	0	2	0
Marsh sandpiper	1	1	0	0	0	0	0	0	0	0	1	0
Greenshank	19	2	17	10	7	16	12	2	17	0	8	9
Wood sandpiper	4	1	2	0	0	0	0	0	1	0	1	0
Terek sandpiper	1	0	6	6	6	1	0	0	0	0	0	0
Common sandpiper	3	2	2	0	0	0	0	0	0	0	2	0
Ruddy turnstone	17	18	28	15	12	44	38	0	17	0	26	0
Sanderling	1	0	0	0	0	0	0	0	0	0	0	0
Little stint	1	1	1	0	0	0	0	0	1	0	1	0
Curlew sandpiper	240	140	159	67	46	14	10	1	78	0	65	0
Common snipe	1	0	0	0	0	0	0	0	0	0	0	0
Green sandpiper	2	0	0	0	0	0	0	0	0	0	0	0
Grey-tailed tattler	0	0	0	0	0	0	1	0	0	0	0	0
Grey heron	3	1	6	4	6	4	2	1	4	1	1	1
Green-backed heron	1	2	3	2	2	4	3	1	2	1	3	2
Cattle egret	3	1	1	0	1	0	1	5	0	0	8	0
Little egret	1	1	3	0	0	0	0	0	0	0	0	0
Black-crowned night heron	0	0	0	0	1	1	0	0	0	2	1	0
Garganey	2	2	0	0	0	0	0	0	0	1	0	0
Moorhen	3	2	2	1	2	0	1	3	4	2	2	1
White-winged black tern	0	0	0	0	0	0	0	0	0	0	2	0
Saunder's tern	1	0	2	2	0	0	0	0	0	0	0	0
White wagtail	0	0	0	0	0	0	0	0	0	0	2	0

Note: Only one count was made in August.

Prey abundance and migrant shore bird distribution

J. Gerlach & R. Gerlach
PO. Box 207, Victoria, Mahé, SEYCHELLES

Key words: Seychelles, shorebirds

Abstract

A study of shorebird numbers, feeding patterns and prey abundance on Mahé, Seychelles in December 1993 was repeated in July 1994 to investigate seasonal aspects of abundance. Vertical zonation of prey was also investigated. Abundance changes were detected, these were probably correlated with changes in sediment type resulting from river flow and tidal patterns. Vertical zonation of prey was confirmed and discussed with reference to the sampling methods used in the study.

Introduction

The invertebrate faunas and substrate types of the different areas exploited by migrant waders on the east coast of Mahé, Seychelles, were first studied in December 1993 (Gerlach & Gerlach 1994). This study was repeated in July 1994 in order to investigate seasonal changes in invertebrate abundance. In addition, it had been suggested that the method used in the original study may have provided inaccurate results as only the top 2.5cm of silt were samples (Hockey *pers. comm.*). The second study was designed to investigate this possibility.

Methods

The 1993 study investigated five areas on the east coast of Mahé, Seychelles:

1). Cascade mudflats
2). mudflats near the Seybrew factory
3). Roche Caiman Bird Sanctuary
4). channel near the Harbour View guest house
5). Inter-Island Quay

Of these, Site 4. was not used by many waders and was rapidly being choked by the growth of mangroves, this site was excluded from the 1994 study. Site 3. had provided insignificant numbers of invertebrates and was also excluded. The remaining three sites were resampled on 8th July 1994.

The methods used were those of the 1993 study; sieving 0.05m^2 of mud through 0.75mm mesh (not 1mm as stated in Gerlach & Gerlach 1994) allowed collection of macro-invertebrates. Visual estimates of numbers in square metre quadrats were used for fiddler-crabs (*Uca* spp.). The volume of silt remaining in the sieve was recorded (in cm^3 per 0.05m^2) to allow a comparison of the approximate particle size of the mud. A number of samples were taken at Site 5. These were taken at different depths (0-2.5cm, 0-5cm, 0-10cm, 0-20cm) and sieved as described above. This allowed data collection down to 20cm. Below this depth the silt was

extremely fine and dense, there appeared to be no macro-invertebrates in this silt which also presented considerable practical difficulties in sampling. Comparison of the animals collected in each sample provides an indication of their distribuion.

Results & Discussion

The results are presented in Table 1. in numbers of individuals per m^2.

Table 1.

	Animals per m^2	1. 1993	2. 1993	5. 1993	1.	2.	5. 2.5cm	5. 5cm	5. 10cm	5. 20cm
Mollusca	*Terebralia*	20	0	0	0	0	0	0	0	0
	Assimineidae	0	0	40	0	0	0	0	0	0
	pink bivalve	0	0	0	0	0	288	36	108	144
	tiny bivalve	0	0	0	0	36	0	0	36	108
Annelida	Polychaeta	540	40	0	0	0	0	108	108	72
	Oligochaeta	0	0	0	0	0	36	0	36	0
Crustacea	*Uca*	0	180	240	108	36	0	0	36	42
	Decapoda	0	0	0	0	0	0	0	0	1
	Isopoda	0	0	60	0	0	0	0	0	0
	Tanaidacea	3380	60	10280	2016	990	108	144	36	108
Total		3920	280	10620	2124	1062	432	288	360	475
silt (cm^3)		130	125	250	25	100	50	62	86	150

Inter Island Quay data demonstrate vertical zonation of animal numbers and diversity. Consideration of the numbers of species found in samples of different depth allow the zonation pattern to be determined as shown in Table 2.

Table 2. Animal numbers in vertical zonation

Depth	Silt volume	Decapoda sp.	*Uca* sp.	Tanaidacea	pink bivalve	tiny bivalve	Oligochaeta	Polychateata
0	-	1	18	0	0	0	0	0
1	20	0	36	0	0	0	0	0
1-2.5	30	0	0	99	144	0	18	0
2.5-5	12	0	0	0	0	0	0	128
5-10	24	0	0	0	0	36	0	0
10-20	64	0	0	0	0	72	0	0

The main features of zonation are that crabs are found near the surface (high abundance in deeper samples being due to high sample variance), tanaidaceans are abundant 2.5cm below the surface in the detritus layer, annelids are present in detritus layers. Oligochaetes are found in low numbers in the upper organic layer and polychaetes in greater numbers down to 5cm below the surface. Bivalves occur at 1-20cm. The common pink species is most concentrated in upper organic layers but is replaced in deeper sediments by an uncommon tiny black species.

These samples indicate that there is significant vertical zonation of mud-inhabiting fauna around Mahé. This has interesting ecological implications but is

considered here in terms of shorebird prey distribution. The main prey items are probably the crabs, tanaidaceans and annelids. Crabs and shrimps are restricted to the top 2.5cm of mud. Of the annelids the Oligochaeta are also restricted to the top 2.5cm, the more numerous Polychaetea occur in the 2.5-5cm layer. These data indicate that the sampling method used earlier (Gerlach & Gerlach 1994) would have under-sampled the available prey by excluding the majority of polychaetes although crabs, tanaidaceans and oligochaetes will have been sampled more accurately. Thus it is to be recommended that future studies sample the top 5cm.

Seasonal changes in prey abundance (bearing in mind the under-representation of polychaetes in 2.5cm samples) are also indicated. Some taxa that were present in small numbers were not found in the new samples (eg. *Terebralia* in Site 1., Assimineidae in Site 5., isopods in Site 5.). New arrivals are also present in small numbers (bivalves in Sites 2. and 5., oligochaetes in Site 5.). Polychaetes are absent from Sites 1. and 2. (although, as indicated by the zonation samples they may have moved into lower layers of the sediment - such changes in distribution should be investigated further). The numbers of *Uca* sp. have changed substantially; in Site 1. numbers have increased by 1080%, but have declined in Site 2. by 80% and were not collected in Site 5. Tanaids have declined in Site 1. by 40%, increased in Site 2. by 1650% and declined in Site 5. by 99%. This varied pattern of increase and decline may be related to changes in the volume of silt retained by the sieves. Silt volume decreased in Site 1. by 81%, Site 2. by 20% and Site 5. by 80%. Faunal changes in Sites 1. and 5. are similar and both showed dramatic decreases in silt volume. This may suggest that seasonal changes in the structure of the silt (specifically the relative coarsness of silt in January/December when river flow is at its strongest, and hence the fine silt particles are being removed most rapidly) may influence the abundance and/or distribution of the fauna resident within it. The general picture revealed by these small scale studies is one of high interstitial shrimp abundance in sites and seasons with coarse sediment and high annelid abundance in finer sediments. Further studies are required to clarify seasonal effects and to evaluate seasonal effects on the vertical zonation pattern.

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NPTS RESEARCH PROJECTS

Conservation of the Seychelles giant tortoise

Historically most of the islands of the western Indian Ocean were inhabited by giant tortoises. As in the Galapagos many of these were distinct island races or species. Most of these populations were exterminated shortly after their discovery and it has been generally accepted that all the surviving giant tortoises of the region belong to the Aldabran species *Geochelone (Dipsochelys) dussumieri* (Gray, 1831) (note that the correct specific name for this species is *dussumieri*, not *gigantea* which is in fact a Mascarene tortoise, or *elephantina* which is a junior synonym of *dussumieri*).

In January 1995 two unusually shaped tortoises in a captive herd in a hotel garden in Seychelles were brought to the attention of the Nature Protection Trust of Seychelles. These very large tortoises (over 1 metre straight carapace length) appeared to show some of the characters exhibited by museum specimens of the extinct Seychelles species. The skeleton of a third tortoise, from the same source, is in the collection of the NPTS. A comparison of the skull with museum specimens confirms that this animal is distinct from the Aldabran species; it is believed that it and the two living tortoises are survivors of one of the original Seychelles species. So far we have been unable to identify the species, it is definitely not *G. dussumieri* or *G. arnoldi* (Bour, 1983) (a Seychelles species), research is continuing into wheter or not it can be identified as *G. hololissa* (Gunther, 1877) or whether it requers a new specific name. All Seychelles species were believed to have been exterminated before 1840. This morphological study is being followed up with a genetic comparison.

The Nature Protection Trust of Seychelles is planning a conservation project for the species. As both of the living tortoises are males the first stage of this will be to try to locate other surviving Seychelles giant tortoises in captive herds. If females can be located a captive breeding programme will be implemented with the eventual aim of reintroducing one of the endemic species of Seychelles giant tortoise to Silhouette.

More detailed reports will be published in *Phelsuma* once this early stage of research is complete.

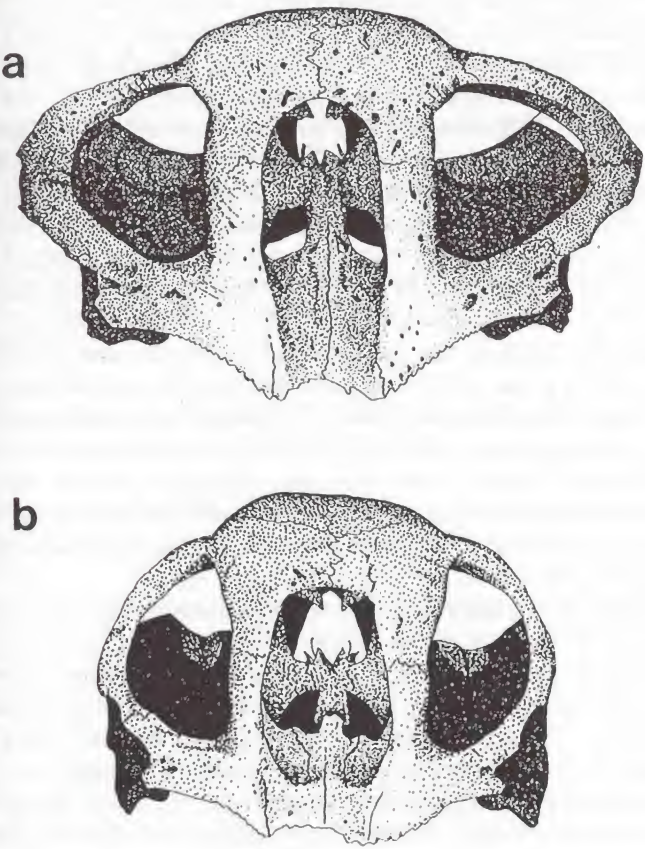

Fig. 1. A). The skull of the rediscovered Seychelles giant tortoise
B). The skull of an Aldabran giant tortoise *G. dussumieri*

NPTS RESEARCH PROJECTS

"Protection of the Coastal Zone" - COI seminar

A paper entitled, "The effects of tourism on the coastal zone of Seychelles - the imbalance of conservation and development" was presented by the NPTS to the Commission of the Indian Ocean's University seminar oo "Protection of the Coastal Zone", held at the Reef Hotel, Mahé, from 23-27 January 1995. We also took part in the five days of deliberations of the seminar which had the intention of finding common ground for solving problems shared by all the states of the western Indian Ocean. Delegates attended from Madagascar, Mauritius, the Comores and Reunion, as wel as from Seychelles. Copies of Phelsuma were distributed to each delegation with the request that they submit articles concerning the biogeography of their respective islands. The paper presented by the NPTS is summarised below.

The geographical location and the nature of the environments of island groups means that tourism is one of the few available economic activities that are viable in the long-term. The role of tourism in Seychelles is particularly central with contributions from agriculture and fisheries being presently unstable. As a major economic activity tourism inevitably has significant effects on the environments in which it operates. The primary function of island tourism being to exploit the attractions of beaches much of the pressure of tourism is concentrated on what can be considered as the coastal zone.

The existing tourist industry of Seychelles developed in response to the increasing numbers of visitors to the islands which, by repute were eccentric islands that could supply all the tourist's requirements, if somewhat erratically. Its most important attributes were those of being a peaceful destination with an excellent conservation reputation. The tourism industry has expanded to profit from and encourage what was a largely accidental or haphazard development. The infrastructure that was built and the resource exploitation that has followed has reached the stage of having virtually destroyed the qualities which initiated the industry. Adoption of the large scale approaches developed on continental multi-national systems in Europe and southern Africa are inappropriate to the small island situation where development has to be modified to fit into the limitations provided by the physical space and raw material supply constraints.

What is needed in Seychelles is a modification of the tourist industry to fit within these constraints; to combine tourism with environmental preservation. This is necessary as the quality of the environment must be preserved if tourism is to be maintained. Further development of the tourism infrastructure should only occur in a manner that reflects the environmental criteria of the location; it is essential that beach crests are preserved, marshes retained and the reef ecosystem protected from pollution. These require a change in emphasis on the part of the tourism industry in general and the formulation and rigorous implementation of legislation appropriate to environmental protection.

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The caddisflies (Insecta; Trichoptera) of Seychelles: taxonomy, zoogeography, biology and conservation.

Hans Malicky
A - 3293 Lunz am See,
AUSTRIA

Key words: Caddisflies, *Hughscottiella*

Abstract:

Ten caddisfly species are known from Seychelles, the taxonomy, biogeography and biology of these are discussed and their conservation status indicated. The fauna contains widespread species and some of Gondwana origin.

Introduction

The Trichoptera (caddisflies) is a medium-sized insect order which means that about 10,000 species have been described so far, and about 20,000 more may be expected. Their closest relatives are the butterflies and moths (Lepidoptera). The earliest caddisflies are known in fossil state from the Permian. The larvae of caddisflies are aquatic; they inhabit a wide range of freshwater biotopes such as streams, rivers, lakes, ponds, temporary pools etc. Two species are marine, and a few others are terrestrial. The general appearance of the adults is that of small to medium-sized moths; they are brownish, greyish or yellowish, and bright colours are rare. The smallest species have a length of about 1 mm. the largest ones may reach 4 cm.

The morphology and behaviour of caddis larvae differ according to family or species. In general, they are caterpillar-like, and many of them construct portable cases made of silk and covered with a variety of sand grains, plant particles, etc. Many larvae construct silken nets to catch their food, which may be fine organic particles, coarse plant material, or living animals. *Hughscottiella* is unique in that it feeds on dead animals.

Caddisflies occur everywhere in the world except Antarctica and some distant oceanic islands. At present, ten species of caddisflies are known from the Seychelles islands:

Hydroptilidae:

Oxyethira sechellensis Malicky, 1993

Hydropsychidae:

Hydromanicus seychellensis Ulmer, 1910

Ecnomidae:

Ecnomus insularis Ulmer, 1910

Ecnomus maheensis Malicky, 1993

Polycentropodidae:

Cyrnodes scotti Ulmer, 1910

Atriplectididae:

Hughscottiella auricapilla Ulmer, 1910

Helicopsychidae:

Helicopsyche palpalis Ulmer, 1910

Helicopsyche kantilali Marlier & Malicky, 1979

Sericostomatidae (?):

Seselpsyche matyoti Malicky, 1993

There has been little research on Seychelles Trichoptera. The species described by Ulmer (1910) were collected in their adult stages by H. Scott during the Percy Sladen Expedition in 1908-09. F. Starmühlner (1976, 1979) collected some larvae in February 1974. G. Marlier (1978) collected larvae and adults in October 1976. From these two collections, *Helicopsyche kantilali* was described. I collected adults and larvae in December 1992, resulting in the discovery of three mores species (Malicky 1993). Marlier described the larvae and pupae of *Hydromanicus seychellensis, Ecnomus insularis* and both *Helicopsyche* species, as well as the striking larva which may well belong to *Hughscottiella auricapilla* in view of its similarity to the confamilial *Atriplectides dubius* from Tasmania and southern Australia (Neboiss 1978), although no pupa has been found to date. The larvae and pupae of *Cyrnodes scotti, Leptodernatopteryx tenuis, Ecnomus maheensis, Oxyethira sechellensis* and *Seselpsyche matyoti* are unknown. Marlier described a small unidentified larva from Starmühlner's collections (Marlier 1978).

Zoogeography

Oxyethira sechellensis may belong to a small group of species which were known from South Africa and Reunion. The widespread genera *Ecnomus* and *Helicopsyche* show no evident affinities. *Hydromanicus* is a genus of many south-east Asian species, and *H. seychellensis* is the only known species outside south-east Asia. *Hughscottiella auricapilla* belongs to the small family Atriplectididae which otherwise includes only *Atriplectides dubius* from Tasmania and Australia. It is therefore certain that it is a Gondwana relict. The affinities of *Cyrnodes, Leptodermatopteryx* and *Seselpsyche matyoti* are still unclear. They may also be relict species.

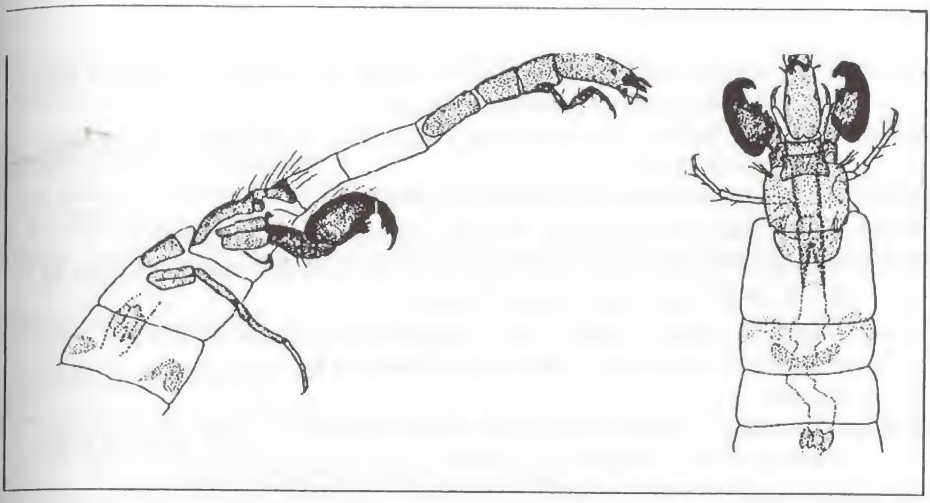


Fig. 1. *Hughscottiella auricapilla* larva showing head extended during feeding (lateral view) and retracted (dorsal view)

Biology

Hydromanicus, Ecnomus, Hughscottiella, Seselpsyche and *Helicopsyche* live in mountain streams. *Cyrnodes* and *Leptodermatopteryx* were caught near "marshy hollows" (Scott 1910); my stay on Mahé in December 1992 was too short to find out what Scott meant by this term, so the biotope of these two species remains unknown. *Oxyethira* has been caught in a mangrove swamp, near water of low salinity.

Helicopsyche larvae are known as "scrapers" which eat the biofilm, i.e. the thin cover on stones in streams which consists of algae, fungi, bacteria, protozoans and the like. *Ecnomus* may live in a similar way, but the possibility that it is also carnivorous cannot be excluded. *Hydromanicus* has a net-spinning larva which probably eats any dead or live organic matter captured in the nets, as is usual in most hydropsychids.

The feeding habits of the larva of *Hughscottiella* which were previously unknown were observed and studied by me during my stay in December 1992. It eats dead animals, but in such a way that the body content is hollowed out from inside, which explains the extraordinary shape of this larva (Fig. 1.). This feeding behaviour is unique among Trichoptera larvae.

Nothing is known of the feeding habits of the larvae of *Oxyethira, Cyrnodes, Leptodermatopteryx* or *Seselpsyche*.

Phenology

Oxyethira sechellensis: one adult was found in December.

Hydromanicus seychellensis: larvae were found in February, October and December; adults from September to March.

Ecnomus insularis: larvae were found from September to February; adults from November to March.

Ecnomus maheensis: adults were found in December.

Cyrnodes scotti: adults were found in November and from January to March.

Hughscottiella auricapilla: larvae were found in February and from September to December adults in December and January.

Leptodermatopteryx tenuis: adults wen found from November to January. An unidentified small larva which could belong to this species was found in February.

Helicopsyche palpalis: larvae were found from September to November and in February; adults in September, October, December and January.

Helicopsyche kantilali: larvae were found from September to November and in February; adults from September to December.

Seselpsyche matyoti: one adult was found in December. The unidentified small larva described by Marlier (1978) was found in February.

There is no other information on the life cycles of these species. Most of them may be acyclic, but complicated annual cycles may also be present.

Distribution and conservation

Oxyethira sechellensis (Map 1.):
Mahé: mangroves at Anse aux Pins
Status: unknown

Hydromanicus seychellensis (Map 1)
Widespread on Mahé and Praslin, probably inhabiting all mountain streams. Records were made from the following places:
Mahé: R. Mamelle (20-40m above sea level), R. du Cap (40-100m), R. Rochon (360m), R. Grand St Louis (100-220m), R. Jasmine (80-1 00m), R. Plaisance (100m), R. Grande Anse (2-200m), R. Athanas (300-350m), R. Quenet (30-40m), R. Cascade West (10m), R. Jouanis, Cascade Estate (250-500), Mare aux Cochons (410-500m), R. Grand Bois (430m)
Praslin: Cascade in the Vallée de Mai (50-200m), R. Baie St Anne
Status: Secure

Ecnomus insularis (Map 1):
Widespread on Mahé and Silhouette. Records were made from:
Mahé: R. Cascade (100m), R. Grand St Louis (90-220m), Cascade Estate (270m), Anse aux Pins mangroves (0m), R. du Cap (100m), Mare aux Cochons (410m)

Silhouette: plateau of Mare aux Cochons (300m)
Status: Secure

Ecnomus maheensis (Map 1):
This species is also probably widespread on Mahé, but has only recently been found at the following localities:
Mahé: Anse aux Pins mangroves (0m), R. du Cap (100m), Mare aux Cochons (410m)
Status: Probably secure

Cyrnodes scotti (Map 2):
This species has not been found since 1909. Its present status is therefore unknown. localities given by Scott:
Mahé: Morne Blanc (270m), Cascade Estate (270m)

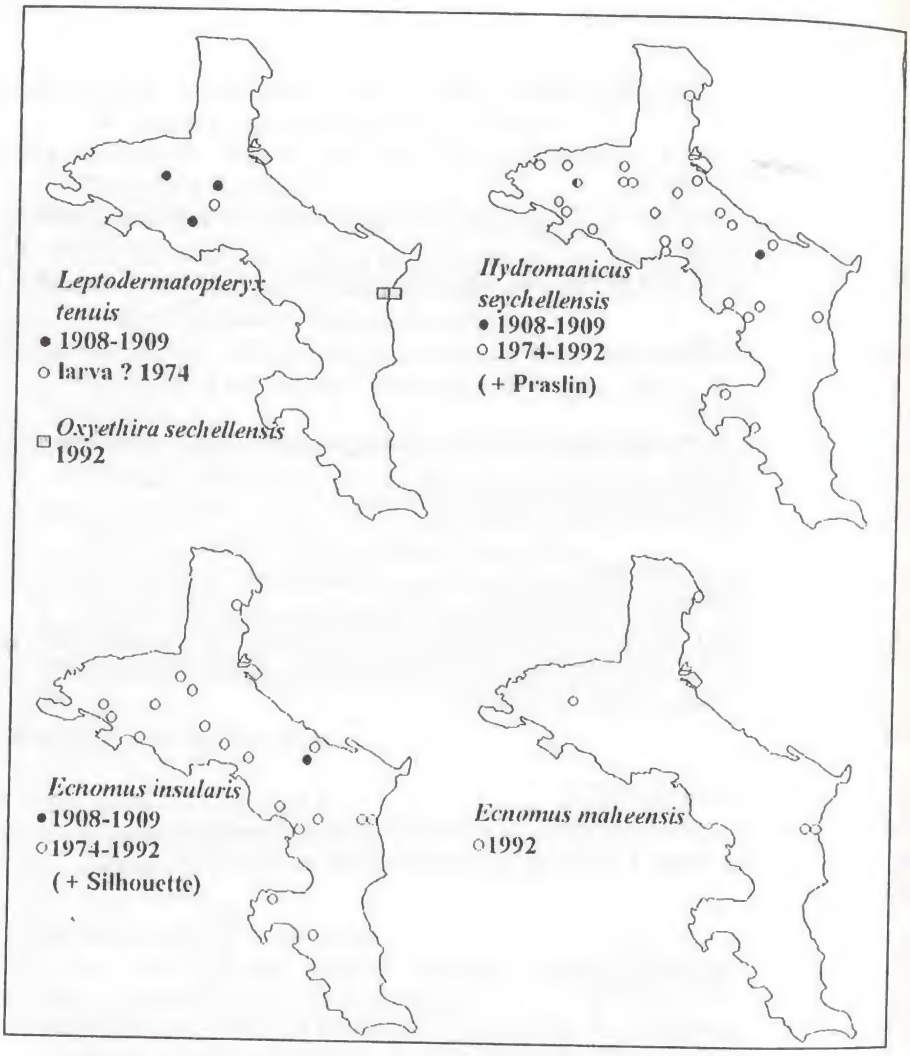
Hughscottiella auricapilla (Map 2.):
Widespread in probably all streams of Mahé,
Mahé: R. Grand Bois near Casse Dent (480m), Cascade Estate (270m), Mare aux Cochons (410-500m), R. Grand St. Louis, R. Islette, R. Cascade West, R. du Cap, R. Grande Anse, R. Danzilles
Status: Secure

Leptodermatopteryx tenuis (Map 1.)
The only adults recorded were found by Scott in 1908 at the following sites:
Mahé: Trois Frères (500m), Morne Blanc (270m), Mare aux Cochons (500m)
Status: Unknown.

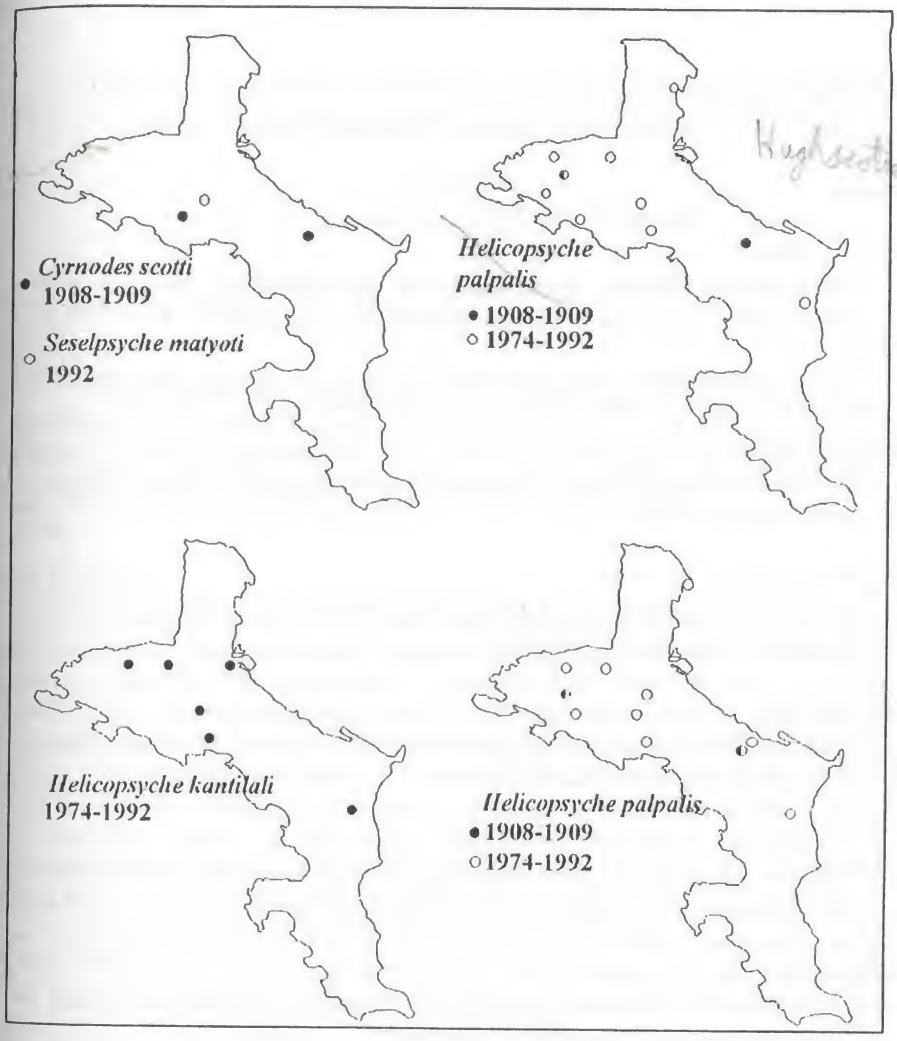
Helicopsyche palpalis (Map 2.)
Records from Mahé are as follows:
Mahé: R. Rochon (360m), R. Athanas (300-350m), R. Cascade (10-500m), Cascade Estate (270m), Mare aux Cochons (300-500m), North-east Point, R. Grand St. Louis (250-550m), R. Grande Anse (50m), R. Grand Bois near Casse Dent (480m), R. du Cap (100m)
Status: Secure

Helicopsyche kantilali (Map 2.)
Widespread on Mahé:
Mahé: R. Grand Bois (480m), R. Athanas (300-350m), R. Quenet (30-40m), R. Grand St. Louis (220m), R. Grand Anse, R. du Cap (100m)
Status: Secure

Seselpsyche matyoti (Map 2.)
Only one adult was found at R. Grand Bois near Casse Dent, 430m, on Mahé. Its status is unknown.



Map 1. Distribution of caddisflies on Mahé



Map 2. Distribution of caddisflies on Mahé

Acknowledgements

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Tropical leaf litter inhabiting invertebrates, patterns of abundance and sampling methods

J. Gerlach
PO Box 207, Victoria, Mahé, SEYCHELLES

Key words: Seychelles

Abstract:

Two studies of leaf-litter inhabiting invertebrates in Seychelles are reviewed. It is concluded that the most useful method of ecological investigation for this group is to use a Winkler apparatus and Tullgren funnel to sample litter inhabiting animals. This is the methodology used in studies undertaken by the Nature Protection Trust of Seychelles. The data do not demonstrate significant seasonality in numbers but do indicate seasonal distribution patterns. This should be taken into account during future studies.

Introduction

Large numbers of terrestrial invertebrates have been collected from Seychelles over the last 150 years. Many of these have been subject to taxonomic study but prior to 1988 no quantitative estimates of abundance had been made. In 1988 Birdlife International started a long-term study of invertebrate abundance on Fregate island as part of the Seychelles Magpie Robin Recovery Plan (Komdeur 1988). These studies were extended to cover Aride island in 1989 (Castle & Mileto 1991), sampling continues on Fregate but was terminated on Aride in 1994. In 1990 an ecological survey of the *Pisonia sechellarum* Friedmann, 1987 forest on Silhouette was undertaken (Oxford University Silhouette Expedition 1990). This included a extensive leaf litter sampling for invertebrates. Since then there has been an ongoing project to collect comparative data from all habitat types in the islands (Nature Protection Trust of Seychelles 1993). An important aspect of both projects has been the comparison of samples from different times of year to determine if there is any seasonal pattern of abundance. The results of these comparisons and the value of data arising from the different methods of the two projects is discussed below. In this discussion the studies on Fregate are considered in detail (those from Aride being restricted in number and being inconsistent in their methodology), those undertaken by the Oxford University Silhouette Expedition 1990 and the Nature Protection Trust of Seychelles are referred to as NPTS studies.

Methods employed by the projects

Phelsuma 3 (1995); 23-27

Fregate study - The method used has been to take a 12.5cm diameter sample of soil and a 30×30cm sample of leaf-litter. Within each sample the number of invertebrates measuring over 1cm long (0.5cm for beetles and spiders) was determined by sorting through the sample by hand. 7 samples were taken at each site, this has been repeated quarterly (Komdeur 1988; Gretton 1991; McCulloch 1993). This method was employed on both Fregate and Aride until 1993 when the Aride method was altered to reduce the soil sample diameter to 10cm and to count all animals longer than 0.5cm for all groups (Lucking & Ayrton 1993).

NPTS studies - During the Oxford University Silhouette Expedition 1990 fifteen $4m^2$ samples were taken, covering a total area of $60m^2$. Only leaf litter was sampled. This was sieved using a 2.5mm mesh to remove the larger leaves and twigs which were then sorted by hand to remove the larger animals. The residue was placed into net bags and hung in a Winkler apparatus, which gradually dried the litter over a period of 3-4 days. As the litter dries the animals move to the surface and fall through the net bag into a container of alcohol below. After 3-4 days the residue was further sorted by hand to ensure that all animals had been extracted. All animals collected were then recorded, irrespective of size.

This method was employed at the sites studied subsequently using at least 10 samples, with two modifications: area per sample was reduced to $1m^2$ to speed up the drying process and two forms of litter container were used within the Winklers. In some samples net bags were used as in the original method, in others wire mesh trays were used. The net bags hold small quantities of litter in a vertical alignment whereas the mesh trays hold larger quantities horizontally. The efficiency of the two containers are compared below. Samples were taken in June/July and December/January to compare dry and wet seasons respectively.

As these methods appear to be unreliable for collecting microscopic invertebrates (primarily collembola and mites) (Oxford University Silhouette Expedition 1990) additional data on these groups were collected by the use of a standard Tullgren funned with a funnel containing $0.01m^2$ of leaf litter above a container of alcohol and below a light bulb, providing a source of heat. The data collected by this means were compared with the Winkler data from equivalent sites to assess the efficiency of Winklers in mite and collembolan collection.

Comparisons

Litter containers in the NPTS studies were compared using a comparison of percentages of different taxa extracted from *Casuarina equisetifolia* leaf litter in the Roche Caiman Bird Sanctuary (Table 1.). As can be seen from this comparison the efficiency of net bags (indicated by the percentage of each taxon extracted) significantly exceeds that of mesh trays only for isopods and arachnids. No Diptera, Mallophaga or Coleoptera were found in mesh tray samples or Symphyla in net bags so these cannot be compared. This indicates that the use of net bags is preferable to trays as it reduces the need for hand sorting for isopods and arachnids.

Table 1. Litter container efficiency in the Roche Caiman Bird Sanctuary
significant differences marked with an asterisk (using a comparison of two Poisson distributions for 10 samples)

Taxon	Mean number extracted		Mean number in residue		% extracted	
	net bag	mesh tray	net bag	mesh tray	net bag	mesh tray
Hymenoptera	4	2	4	1	50	67
Dictyoptera	1.5	1	1	1.5	60	40
Diptera	1	0	1.5	0	20	-
Mallophaga	5	0	2	0	71	-
Coleoptera	1	0	0	0	100	-
Isopoda	4.5	20	1	17	82*	54
Symphyla	0	26.5	0	1.5	-	95
Arachnida	2.5	2	2	7	56*	22

Table 2. Microinvertebrate numbers in leaf litter samples on Mahé

Taxon	Site	Mean density (m^{-2})		t	P
		Winkler	Tullgren		
Mites	Bird Sanctuary	158.8	590.0	3.51	0.007 **
	Le Niol	54.8	708.0	2.23	0.089
	Congo Rouge	20.7	10.0	0.83	0.468
Collembola	Bird Sanctuary	161.8	910.0	2.32	0.077
	Le Niol	20.7	40.6	0.68	0.534
	Congo Rouge	3.7	3.50	0.14	0.898
Mallophaga	Bird Sanctuary	6.0	50.0	1.39	0.237
	Le Niol	0.9	50.0	1.79	0.148
	Congo Rouge	0.3	0.0	0.77	0.495
Pseudoscorpiones	Bird Sanctuary	0.0	0.0	-	-
	Le Niol	0.3	0.0	1.94	0.082
	Congo Rouge	0.3	0.0	0.77	0.495

A comparison of the numbers of microinvertebrates collected by Winklers and Tullgren funnels is given in Table 2. The only significant difference between the
Winkler and Tullgren funnel samples is that of mites at the Bird Sanctuary. Of the three sites compared this has the highest mite density, although mites are abundant at the other sites their distribution is sufficiently patchy to mean that the variance is sufficiently high to prevent statistical significance. The significance level achieved decreases in accordance with altitude because variance also increases with altitude (probably due to climatic effects). A similar pattern is demonstrated by the collembola data, although this time without significance in the Bird Sanctuary. Further samples from a range of sites are required to validate these comparisons.

Seasonality was investigated in NPTS samples by a t-test of the numbers of each taxon collected at three sites in two seasons. 10 samples were available from each site and season. The three sites selected are at different altitudes allowing

Table 3. Seasonal changes in invertebrate abundance on Mahé

Site	Taxon	Mean number		t	P
		July	January		
Bird Sanctuary	Amphipoda	12.5	3.8	2.4	0.042 *
Le Niol	Isopoda	4.9	0.0	2.38	0.039 *
Le Niol	Lepidoptera	0.7	0.0	2.33	0.045 *
Le Niol	Hymenoptera	1.9	47.0	38.48	0.000 ***

identification of any altitude effects on seasonality. The sites were Roche Caiman Bird Sanctuary (0m above sea level), Le Niol (250m), Congo Rouge (700m). Significant results are shown in Table 3. and all data summarised in Appendix I. Differences in abundance between the two seasons are significant for Bird Sanctuary amphipods, and Le Niol ants, lepidoptera and isopoda. No seasonal effects are detectable in the stable mist forest climate of Congo Rouge.

The lack of widespread seasonality makes the four groups that do appear to show some effects worth further consideration. It should be noted that there is no consistent pattern in the significant taxa; amphipods, Lepidoptera and woodlice are abundant in June whereas ants are most abundant in December.

The Bird Sanctuary amphipods are present in the leaf litter throughout the year and appear to be randomly distributed in the December samples (present in 70 % of samples). In June they are found in fewer samples (10 %) but in very high numbers. This can be explained by the observation that in all the high density samples in June amphipods were congregated under lumps of coral. These were probably sheltering in the relatively humid microclimate under the coral as, in this season, most of the leaf litter is considerably drier than in January. Thus the apparent seasonality in numbers may be an artefact of seasonality of distribution.

Lepidoptera and woodlice abundance in June at Le Niol goes against the expected pattern of low dry season numbers and is a misinterpretation of the data. Rather than abundance in June, these should be seen as being uncommon in December. In all samples where numbers are below the mean for that season ants are present at high densities. This indicates that seasonality does not influence numbers directly, rather ant numbers are the primary factor influencing their abundance. This is not surprising as both groups are flightless (Lepidoptera represented by larvae and pupae only) and subject to high levels of predation by ants ('Hymenoptera' in tables). Ant abundance follows the expected seasonal pattern: present in low numbers in most samples but in very high numbers in a single sample. Unlike amphipods this does not appear to be a seasonal microclimate restriction but results from colonial behaviour causing a single sample

to increase the mean to such a level that a significant difference is unavoidable, despite a lack of any real seasonal influence. None of these differences is significantly correlated with rainfall (Pearson's rank correlation coefficient $P>0.05$ for all cases), thus the NPTS data do not identify any effect of season on animal abundance at any altitude.

Seasonal effects have been reported from Fregate (Komdeur 1988) but not Aride (Lucking & Ayrton 1993). Statistical analysis of the published data do not support these reports as animal numbers are not significantly correlated with either the date or the monthly rainfall total. The reported changes concern percentage changes in total fauna in each habitat type between consecutive samples. The demonstrated abundance changes do not conform to a seasonal pattern and may be due to other changes within the habitat, such as tree planting and livestock movement. Seasonal changes are further obscured by the very high variance figures recorded as a result of the very small sample sizes.

Summary

The data presented above demonstrate that the most useful means of collecting leaf-litter inhabiting invertebrates is to use use a Winkler apparatus for the extraction of most taxa. This should be supplemented by the use of a Tullgren funnel to collect micro-invertebrates. In the Winkler either mesh bags or wire trays can be used, the former are the most efficient for most groups.

Seasonality was not detected in the numbers of different invertebrates from three different altitudes. There was a seasonal pattern of distribution in some groups, most obviously amphipods. This will result in sampling errors from small scale studies and should be taken into account. The lack of seasonality in numbers means that samples can be compared irrespective of season of collection as long as the area covered is sufficient to overcome the distributional problem (over $10m^2$).

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Appendix I. Mean numbers of invertebrates at each site

Site	Taxon	Mean number		t	P
		July	January		
Bird Sanctuary	Annelida	0.0	0.3	0.42	1.000
	Mollusca	5.3	5.0	0.30	0.725
	Amphipoda	12.5	3.8	2.43	0.042
	Isopoda	58.8	112.0	0.89	0.405
	Myriapoda	0.2	11.7	0.91	0.455
	Araneae	5.2	8.3	0.51	0.631
	Thysanura	0.2	0.0	0.68	0.516
	Psocoptera	1.2	1.3	0.13	0.897
	Dictyoptera	0.8	1.7	0.67	0.520
	Dermaptera	1.2	4.7	1.44	0.281
	Mallophaga	6.0	5.3	0.20	0.847
	Homoptera	0.2	0.0	0.68	0.516
	Diptera	4.0	1.7	0.73	0.491
	Lepidoptera	3.7	0.3	1.20	0.370
	Hymenoptera	13.5	8.3	0.53	0.609
	Coleoptera	6.8	6.3	0.58	0.621
Le Niol	Nemertea	0.0	1.0	0.43	0.667
	Annelida	2.0	0.0	0.87	0.478
	Mollusca	12.2	15.0	0.67	0.510
	Myriapoda	2.2	0.5	1.10	0.298
	Araneae	5.9	0.0	1.92	0.090
	Opilionida	2.0	1.0	0.43	0.707
	Schizomida	0.3	3.5	5.89	0.060
	Pseudoscorpiones	0.3	0.0	1.96	0.081
	Isopoda	4.9	0.0	2.38	0.039 *
	Amphipoda	0.0	1.0	0.67	0.500
	Psocoptera	2.5	0.5	1.25	0.241
	Dictyoptera	1.6	3.5	1.13	0.284
	Dermaptera	0.0	16.5	33.00	0.190
	Mallophaga	0.4	0.0	0.78	0.454
	Hemiptera	1.0	0.0	1.81	0.204
	Diptera	0.0	1.0	0.42	0.667
	Lepidoptera	0.7	0.0	2.33	0.045 *
	Hymenoptera	1.9	47.0	38.48	0.000 ***
	Coleoptera	9.1	6.0	1.11	0.293
Congo Rouge	Mollusca	5.7	9.0	0.50	0.667
	Isopoda	1.7	0.0	0.94	0.444
	Myriapoda	1.6	9.0	1.00	0.557
	Thysanura	0.3	0.0	0.50	0.667
	Psocoptera	0.3	0.0	0.50	0.667
	Dermaptera	0.3	0.0	0.50	0.667
	Orthoptera	0.0	1.0	0.52	0.720
	Mallophaga	0.3	0.0	0.50	0.667

	Diptera	4.3	2.0	0.63	0.594
	Hemiptera	0.3	0.0	0.50	0.667
	Hymenoptera	32.3	6.0	0.51	0.663
	Coleoptera	7.7	11.0	0.61	0.604

Seed predation and flower visiting by *Epicroesa* sp. (Lepidoptera: Heliodinidae) on a rare Seychelles tree.

Graham J. Floater

Department of Entomology,
University of Queensland,
St Lucia, 4072,
Queensland, AUSTRALIA.

Key words: mutualism, *Pisonia sechellarum*, pollination, seed predation

Abstract:

The interaction between the moth *Epicroesa* sp. and the rare Seychelles tree *Pisonia sechellarum*, is outlined. Seed predation by *Epicroesa* caterpillars is quantified and the incidence of the moth and other insects visiting the *Pisonia* flowers is discussed. This preliminary study suggests an antagonistic mutualism between tree and moth.

Introduction

From July to September 1990, the Oxford University Silhouette Expedition surveyed the unique flora of a small area of mist forest, dominated by the rare tree species *Pisonia sechellarum* Friedmann, 1987 (Nyctagynaceae), on Silhouette Island in the Seychelles (Oxford University Silhouette Expedition 1990). When several *P. sechellarum* trees flowered towards the end of the project, the opportunity was taken to observe insect visitors, and seed predation was quantified. From this work, a close interaction between a microlepidopteran and the tree was found. The moth is an undescribed species of *Epicroesa* (Lepidoptera: Heliodinidae); a small genus made up of five other species from Australia, New Guinea and Japan. The moth is the most frequent visitor at the flowers, and the moth larvae feed on the flowers and seeds of the tree.

Pisonia is a widespread genus of about 35 species (Steenis 1972) *P. sechellarum* was described after its discovery in 1983 between Mont Dauban and Mont Pot a Eau on Silhouette Island (Friedmann 1986). While it may have occurred previously on the island of Mahé at the summit of Morne Blanc (Robertson 1989), the few trees on Silhouette are the only individuals of this species known to exist today. This unique stand of about 200 trees covers an area of 0.48 hectares near the main ridge of the island (a detailed description of the site is given in Oxford University Silhouette Expedition 1990).

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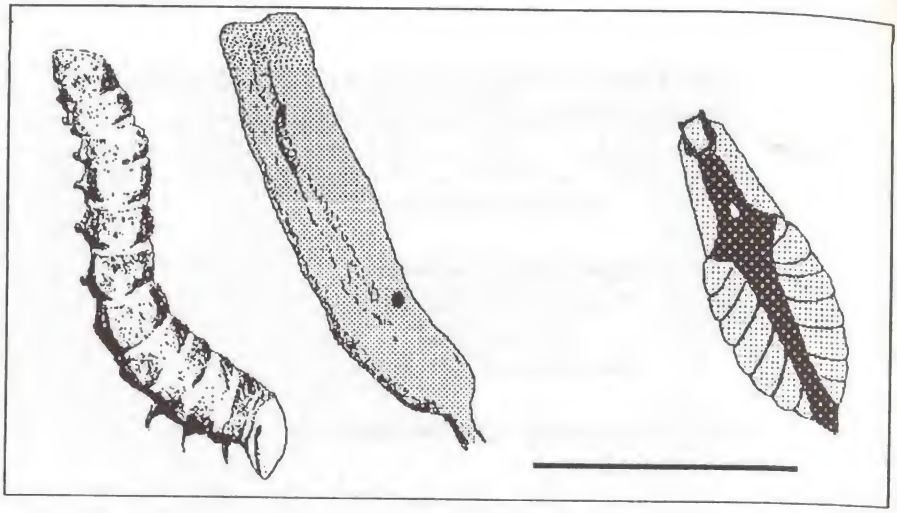

Fig. 1. *Epicroesa* larva, exit hole in *Pisonia sechellarum* fruit and *Epicroesa* pupa. Scale bar: a) = 2mm, b) = 8mm, c) = 2.5mm

The pale yellow flowers, each 4-6 mm long, grow in clusters of 50 to 300, arranged in a panicle at an apical shoot of the tree (Robertson 1989; Gerlach 1994). A single cluster contains either all male or all female flowers, and the tree relies on insects for pollination. At the beginning of September (the end of the expedition) the most mature fruits were green, cylindrical and up to 50mm long. Each fruit contained one seed.

Methods

Four flower clusters, two male and two female, were observed from 1800h (sunset) to 0700h (one hour after sunrise) on the 8th/9th of August 1990. During this time, no insects were observed visiting the flowers. A second night visit between 1900h and 2300h on August 17 also found no nocturnal flower visitors. On September 6, a cluster of female flowers was observed for three hours commencing at 0800h. The species and the time or arrival and departure of each insect to and from the cluster were recorded. From these data, the number of visits and the average time spent by each insect at the cluster were calculated. The inaccessibility of male flowers prevented direct observations of a male cluster. Instead, insects present on three male clusters were collected by surrounding each cluster with a transparent plastic bag and shaking the insects off the flowers. Another 5 clusters of female flowers were also sampled in this way. All 8 clusters were sampled on August 31 and later sorted.

Two hundred fallen fruits were collected from the forest floor, and then cut open using a scalpel. A record was made of the number of fruits containing a larva or showing signs of previous occupancy, as well as the number of intact fruits. All larvae were the distinctive white and black-banded caterpillars of *Epicroesa*, ten of

which were reared through to maturity in Petri dishes. Frass, seed attack and a neat round exit hole through the fruit wall were used as indicators of previous occupancy by *Epicroesa*. A similar record was made for a cluster of 32 fruits, which were still growing on a tree in the area of the fallen fruits (due to the rarity of *P. sechellarum*, no other clusters were sampled). All fruits observed remaining on the trees in this area were of similar maturity. Additionally, the number of female flowers growing in five different flower clusters was recorded, as well as the number of fruits remaining in four fruit clusters.

Results

Regular visitors to the female flowers were *Dichaetomyia fasciculifera* (Stein, 1910) (an endemic muscid fly), *Epicroesa* sp. and several species of *Drosophila*. *Drosophila* were always present in high numbers (7-13 individuals), but remained on the clusters for long periods (generally more than 2 hours). Nevertheless the number of visits to and from the flowers was still relatively high (9 times in 3 hours). *D. fasciculifera* and *Epicroesa* sp. both made a large number of visits (18 and 7 respectively) and stayed on the cluster only 5 to 10 minutes at a time. It should be noted that *Dichaetomyia* is strongly attracted to humans, and it is likely that some individuals alighted on the flowers as a consequence of the observer's presence. A single visit was made by the pyralid moth *Bradina aureolalis* Joannis, 1899. Another unidentified dipteran species also visited the flowers during the 3 hour study.

The number of insects collected from male and female flower clusters was low (Table 1.). *Epicroesa* sp. was the only species present in large numbers on both male and female flowers, representing 77% of flower visitors. *Drosophila* sp. and

Table 1a. Insect visitors on 3 clusters of male flowers

Species	Cluster 1	Cluster 2	Cluster 3	Total
Drosophila spp.	0	0	1	1
Epicroesa sp.	1	5	5	11
B. aureolalis	0	0	1	1
Others	0	1	1	2
ant colonies	1	0	1	2
Epicroesa larvae	0	2	0	2

Table 1b. Insect visitors on 5 clusters of female flowers

Species	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	Total
Drosophila spp.	2	2	0	1	0	5
Epicroesa sp.	17	8	0	0	0	25
B. aureolalis	1	0	1	0	0	2
Others	0	0	0	0	0	0
Ant colonies	1	0	0	1	0	2
Epicroesa larvae	16	3	0	1	5	25

B. aureolalis were both found on male and female flowers. though only one individual of each species was found on male flowers. *D. fasculifera* did not occur on any of the flowers sampled. The results suggest that *Epicroesa* sp. is a major pollinator of *P. sechellarum.*

Epicroesa was the only seed predator or frugivore present in the *Pisonia* fruits, and no parasites emerged from *Epicroesa* larvae collected from fruits reared through to adults. Differences between the extent of *Epicroesa* seed predation in fallen fruits and those remaining on the tree were striking. First, those still growing on the tree were significantly larger than the fallen fruits ($t=43.54$ in a two sample t-test: $p<0.01$) and second, the fruits remaining on the tree were generally intact (5 out of 32 infected). whilst many of the fruits collected from the ground were infected (142 out of 200 infected). A comparison of the proportion of infected fruits on the tree and on the ground gives $\chi^2=34.95$: $p<0.01$. The tree, therefore. seems to abort infected fruits at an early stage of development. Out of 166 caterpillars found in aborted fruits, 45 (or 27%) were dead, probably from starvation.

The results of flower and fruit counts for different trees show that a low proportion of flowers (an estimated 25.3 out of 128, or 20%) develop into viable fruits (table 2). It is evident from the fruit dissections that much of this failure rate is due to attack by *Epicroesa* larvae, with 71% of fallen fruits and 16% of remaining fruits infected. Furthermore, many larvae were found feeding on the flowers themselves, with as many as 16 caterpillars on a single female cluster (Table 1.).

Table 2. Results of flower and fruit counts on different trees (the no. of intact fruits was estimated as 84% of each cluster, being the proportion found in dissected fruits of cluster 8).

Cluster	1	2	3	4	5	6	7	8	9	mean
No. flowers	315	78	84	48	117	-	-	-	-	128
No. fruits	-	-	-	-	-	16	41	32	31	30
Estimated no. of intact fruits	-	-	-	-	-	13.5	34.6	27.0	26.2	25.3

Discussion

The data on flower visits and seed predation, together with additional observations, have been used to construct the following life history of *Epicroesa* sp. The female moth flies from one flower cluster to another, feeding on nectar. Alighting on a female flower, it lays an egg into the ovary (it may feed before or after this act). Although oviposition was not observed at male flowers, caterpillars were present on one male flower cluster. If the female flowers are young, the larva emerges from the ovary and spins a protective tent of silk over a number of flower heads on which it feeds. Caterpillars on the male cluster also spun silk tents. If, however, the flowers are more mature, the fruit develops as normal around the larva. In this case, the larva feeds on the developing seed, and the tree aborts the fruit

before it is fully developed. The larva leaves the fallen fruit via a small exit hole bored through the fruit wall.

Once on the ground (either from the aborted fruit or from dropping on a silk thread from the flower cluster), the caterpillar may crawl a considerable distance to a vertical structure such as a plant stem. The larva then ascends to a pupation site, usually on the surface of a leaf. where it secures itself with a cradle of silk. Details or mating are unknown. This life history has probably evolved from one in which the larva were phytophagous. A similar (perhaps the same) species of *Epicroesa* has been observed feeding on the leaves of *Pisonia grandis* Br., 1810 on Aride Island (Gerlach pers. comm.). As nothing is known of the flowering period of *P. sechellarum, Epicroesa* sp. could also feed on the leaves of this species outside the flowering season.

If *Epicroesa* is pollinating the flowers of *P. sechellarum* (and a further study will be required to confirm this), the moth shares many characteristics of *Greya politella*, a relative of the yucca moths which is a pollinating seed-predator of *Lithophragma* (Pellmyr & Thompson 1992). Like the *G. politella* interaction, the costs of *Epicroesa* sp. to the tree may still outweigh the benefits of pollination if copollinators are involved. In this respect, the interaction differs from obligate mutualisms such as yuccas and yucca moths (Keeley *et al.* 1984; Addicott 1986; Powell 1992) or figs and fig-wasps (Janzen 1979).

The question then arises whether the moth is a threat to the survival of the tree. In this short study, the moth did seem incapable of over-exploiting its food resource, with a number of viable fruits developing, even though many more were destroyed. Due to the nature of the site, any of the remaining viable fruits drop onto bare rock or are eaten by rats. However, while only one *Pisonia* seedling was found in the forest, difficulties of germination may be offset by the longevity of the tree. Side-shoots from fallen trees were common, and in many cases these had developed into mature trees themselves (in one instance, six large trees were found to be offshoots of a single original trunk).

Acknowledgements

I am indebted to the sponsors of the Oxford University Silhouette Expedition and my colleagues on the expedition, all of whom are acknowledged in full elsewhere. I am also very grateful to Dr G. Robinson of the Natural History Museum, London, who identified the moth as *Epicroesa*. Myron Zalucki and David Walter made comments on an earlier draft.

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Epicroesa sp. on male *Pisona sechellarum* flowers

Pisonia sechellarum forest

One of the living Seychelles giant tortoises (photo I. Bullock)

Aldabran giant tortoise (*Dipsochelys dussumieri*) on Curieuse

Common noddy (*Anous stolidus*)
the commonest seabird on Isle aux Vaches Marines

Giant millipede (*Sechelleptus seychellarum*)
recorded on Isle aux Vaches Marines for the first time in 1994

Seychellaria thomassetti

Linyphiid spiders of the granitic islands of Seychelles (Araneae, Linyphiidae)

Michael I. Saaristo
Zoological Museum,
University of Turku,
FIN-20500 Turku, FINLAND.

Key words: *Theoa*, taxonomy

Abstract

Three linyphiid spiders are recorded from the granitic Seychelles. One of them *Microbathypantes palmarius* (Marples, 1955) n. comb. = *Microbathyphantes asiaticus* Helsdingen, 1985 n. syn. belongs to the subfamily Linyphiinae Blackwall, 1859 and two others, *Nesioneta benoiti* (Helsdingen, 1978) n. comb. and *Theoa tricaudata* (Locket, 1982) n. comb. to the subfamily Micronetinae Hull, 1920. *Priscipalpus* Millidge in Beatty, Berry & Millidge, 1991 is placed as a junior synonym of *Microbathyphantes* Helsdingen, 1985, n. syn. *Meioneta benoitia* Helsdingen, 1978 is transferred to *Nesioneta* Millidge in Beatty, Berry & Millidge, 1991. A new genus, *Theoa* n. gen. is created for *Theonina tricaudata* Locket, 1982 which is a new record from the granitic islands of Seychelles.

Introduction

With well over 3500 species the family Linyphiidae Blackwall, 1859 is the second most diverse spider family. They are found all over the world but especially in temperate regions. Their size range between 0.8-12 mm. Linyphiids can be found in a large variety of habitats, mostly living among low vegetation or especially in litter, moss, under stones etc. They are usually not very colourful although there may be some kind of pattern on the abdomen. Linyphiids make horizontal sheet webs, which are usually very small, they live and run on the undersides of these sheets.

Linyphiids are ecribellate spiders with eight eyes in two transverse rows. The chelicerae have teeth on the inner and outer margins and lateral stridulatory organs. Autotomy of legs occurs between the patella and tibia. There is a single dorsal trichobothrium on metatarsi (occasionally lost from MtIV). In the descriptions below its position is given by the expression: TmI = *a*/*b* (i.e. on the metatarsus of the first leg, where *a* is the distance of the trichobothrium from the proximal end of the metatarsus and *b* is the total length of the segment). Male palp with a paracymbium. Its shape and complexity varies within the family but is basically a separate, well sclerotised structure articulating basally via a membranous area with the cymbium on its retro-lateral side. Bulbus with a suprategulum and a more or less complicated embolic division is connected to it with a short,

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membraneous column. A thin and usually highly translucent extension arises from the column. Its apical part is in a close association with the apical part of the embolus.

At present three linyphiid species have been found in the granitic Seychelles. One of them, *Microbathypantes palmarius* (Marples, 1955) represent the subfamily Linyphiinae Blackwall, 1859 and two others, *Nesioneta benoiti* (Helsdingen, 1978) and *Theoa tricaudata* (Locket, 1982) belong to the subfamily Micronetinae Hull, 1920. The general distribution and distribution in the granitic Seychelles are given for each species. All these three species have a wide distribution which suggest that they either move easily with man or are fairly active aeronauts.

The material treated below belong to the following collections:

MRAC = Musée Royal de l'Afrique Centrale, Tervuren, Belgium.
MZT = Zoological Museum of Turku University, Finland.

In the figures the following abbrevations have been used

1. male palp:

c = embolus
cd = embolic plate
cp = embolus proper
fe = fenestra
fgl = Fickert's gland
ia = inferior apophysis
lc = lamella characteristica
mm = median membrane
pa = posterior apophysis
ph = pit hook
r = radix
sa = superior apophysis
sd = sperm duct
st = suprategulum
t = tegulum
ta = terminal apohysis

2. epigyne:

at = atrium
bc = bursa copulatrix
dll = depression on epigyne
dps = distal part of scape
ec = epigyneal cavity
ed = entrance duct
epo = pocket-like depression on epigyne
ll = lateral lobe of scape
lp = lateral pocket
pi = pit
pmp = posterior median plate
pps = proximal part of scape
sb = scapoid base
re = receptacula

Genus *Microbathyphantes* Helsdingen, 1985

Microbathyphantes Helsdingen, 1985: 21. - Type species by original designation *Microbathyphantes asiaticus* Helsdingen, 1985 from Sri Lanka [= *Linyphia palmaria* Marples, 1955 from Western Samoa. **New synonymy**]

Priscipalpus Millidge in Beatty, Berry & Millidge, 1991: 265. - Type species by original designation and monotypy *Linyphia palmaria* Marples, 1955. **New synonymy.**

Species included: *M. palmarius* (Marples, 1955) and *M. spedani* (Locket, 1968).

Diagnosis: The genus is most easily recognized by the elongated, distally bifurcated superior apophysis of the embolic plate of the male palp.

Description: Fairly small spiders, total length ca. 1.7-2.1 mm. Legs proportionally long and slender. TmI = 0.22-0.25. TmIV absent. Chaeto-taxy (dorsal-prolateral-retrolateral-ventral spines): FeI = 1-1-0-0, FeII-III = 1-0-0-0, FeIV = 0-0-0-0, TiI-II = 2-1-1-0, TiIII-IV = 2-0-0-0, MtI-IV= 0-0-0-0. Posterior eyes large and close to each other. Chelicerae with three frontal teeth.

Cymbium without dorsal outgrowth. Paracymbium (pc) simple, more or less flat crook. Suprategulum relatively small, without any hook-like structures. Main body of the embolic division consists of a flat plate, here called the embolic plate (epl). From its anterior face project superior (sa) and inferior apophyses (ia) (=lamella of Helsdingen 1985) while its posterodorsal corner (pdc) is drawn out into a sharply pointed projection. Embolus (e) smooth, coiled, forming a full circle. Its basal part is buried inside the embolic plate freely moving against it. A very thin and translucent membrane, here called the median membrane (mm), arises at junction of the embolus and embolic plate.

The epigyne appears to be relatively simple without any pit in the posteromedian plate. This is apparently associated with the hookless condition of the suprategulum.

Taxonomic position: According to the secondary genital organs the genus is closely related to the *Porrhomma-Bathyphantes* group of the subfamily Linyphiinae. The embolic division is of a fundamentally different type compared to the corresponding structure of representatives of the subfamily Micronetinae (Saaristo 1971: Fig. 1, here Figs. 2C and 3C). Contrary to the statement of Millidge (in Beatty, Berry & Millidge, 1991: 272) there is a suprategulum present in the male palp of *Microbathyphantes*.

Microbathyphantes palmarius (Marples, 1955), **new combination** (Fig. 1A-E)
Linyphia palmaria Marples, 1955: 492 (male & female).
Microbathyphantes asiaticus Helsdingen, 1985: 22, f. 11-12 (male & female). **New synonymy.**
Priscipalpus palmarius Millidge in Beatty, Berry & Millidge, 1991: 272, f. 33-36 (male & female)

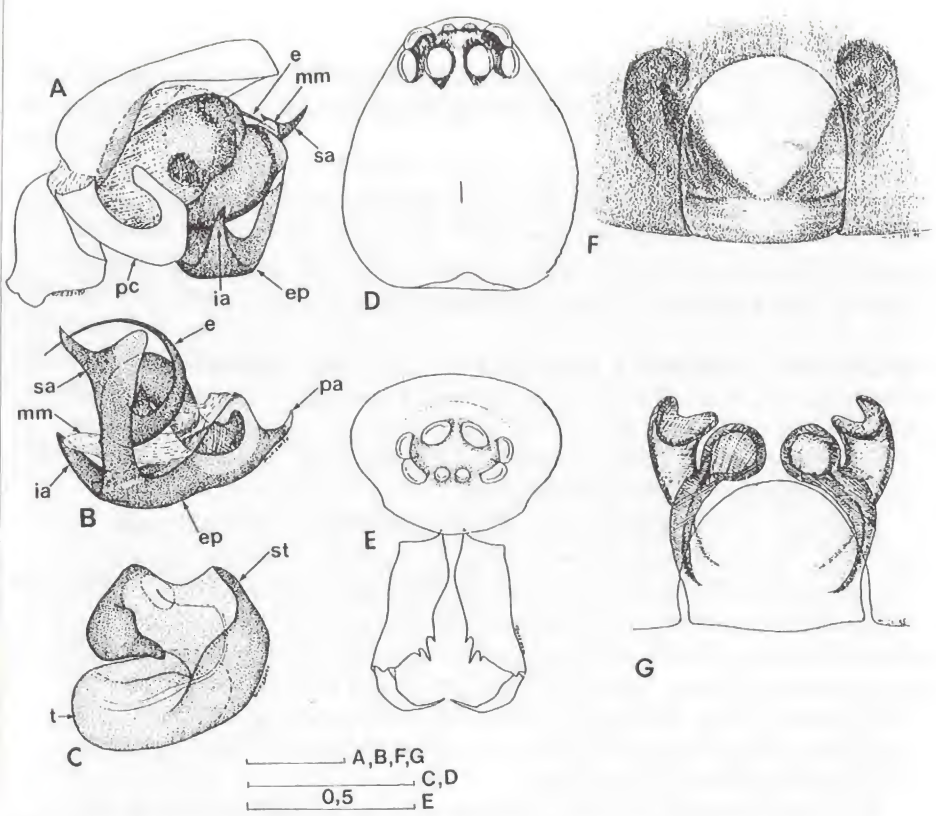

Fig. 1. *Microbathyphantes palmarius* (Marples, 1955). A-E = original figures, F-G after Helsdingen 1985; Beatty, Berry & Millidge 1991. Unless otherwise stated scale bar = 0.1mm.
A) Right male palp ectally. B) Embolic division dorsally. C) Suprategulum dorsally. D) Male carapace dorsally. E) Male carapace and chelicerae frontally. F) Epigyne ventrally. G) Vulva ventrally.

Diagnosis: The male of this species is most easily recognized by the shape of the apical part of the superior apophysis (Fig. 1B). Its anteriorly pointing branch is sharp tooth-like and pointed while the posterior one is somewhat larger, lobe-like and with a round apex.

Description: The species have been well described both by Helsdingen (1985) and by Millidge (Beatty, Berry & Millidge 1991).

Distribution: The species has a very wide distribution; Seychelles, Sri Lanka, Burma, Mariana Islands, Fiji, Samoa and Cook Islands (Helsdingen 1985, Beatty, Berry & Millidge 1991). In the Seychelles the species have been found on:

Cousin: 2 males, 1978, Hugh Watkins legend (MZT AA 0.274 & AA 0.274)

Mahé: Helsdingen (1985).

Discussion: The type locality of the holotype of *Microbathyphantes asiaticus* is Sri Lanka and its paratypes come from the Seychelles and Burma. *Linyphia palmaria* was described from Western Samoa. The Seychelles specimens were compared with the samples of *L. palmaria* from Upolu, Western Samoa (MZT, P.T. Lehtinen legend) and were found to be identical. The minor differences between the figures presented by Helsdingen (1985) for *M. asiaticus* and those of *L. palmaria* (Millidge in Beatty, Berry & Millidge, 1991) are due to the different angles of inspection and drawing techniques.

Genus *Nesioneta* Millidge in Beatty, Berry & Millidge, 1991

Nesioneta Millidge in Beatty, Berry & Millidge, 1991: 265. - Type species by original designation *Nesioneta lepida* Millidge in Beatty, Berry & Millidge, 1991 from Marshall Islands.

Species included: *N. benoiti* (Helsdingen, 1978), *N. pacificana* (Berland, 1935) **new combination** [= *N. concinna* Millidge in Beatty, Berry & Millidge, 1991 **new synonymy**], *N. elegans* Millidge in Beatty, Berry & Millidge, 1991, *N. lepida* Millidge in Beatty, Berry & Millidge, 1991, *N. similis* Millidge in Beatty, Berry & Millidge, 1991, and *N. sola* (Millidge & Russell-Smith, 1992) **new combination**.

Diagnosis: The genus is most easily recognized by the anteriorly flattened male palpal tibia bearing a few wart-like apophyses armed with a single hair.

Description: Fairly small spiders, total length ca. 1.4-1.9 mm. Legs moderately long and slender. TmI = 0.25-0.30. TmIV absent. Chaetotaxy: TiI-IV = 2-0-0-0. No femoral or metatarsal spines.

Male palpal tibia anteriorly flattened, bordered by ectal and mesal brims bearing a few wart-like apophyses armed with a single hair. Cymbium rather simple with a membraneous plate-like extension proximo-mesally. The distal end of the paracymbium (pc) is weakly sclerotized, almost translucent. Suprategulum with a well-developed pit hook (ph) of the same type as in *Agyneta*. Radix (r) U-shaped, heavily sclerotized. Embolus (e) voluminous and very complicated in structure;

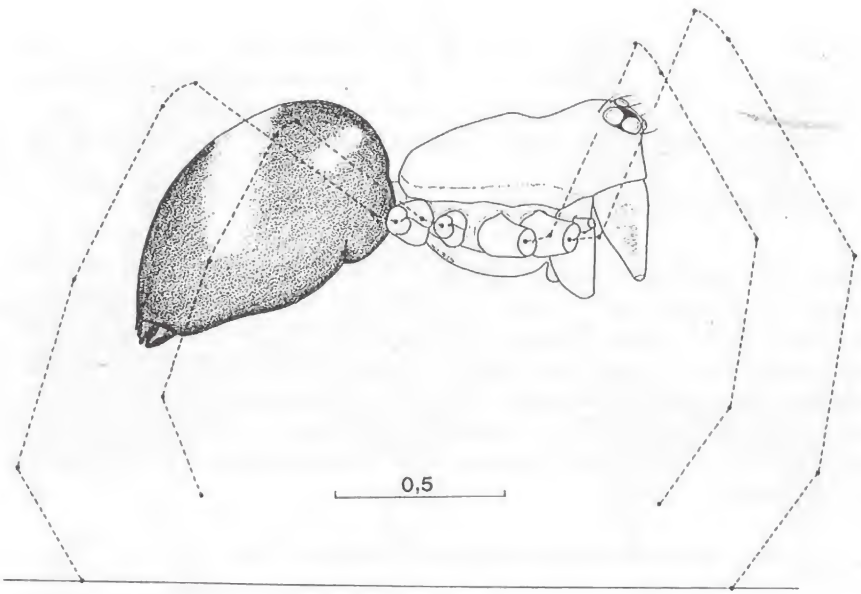

Fig. 2. *Nesioneta benoiti* (Helsdingen, 1978). Dextrolateral view of male. Original figure, scale bar in millimetres.

relatively weakly chitinisized except for a large, somewhat blade-like extension and the two small proximal flaps near the embolus proper (ep). Sperm duct inside the embolus not dilated but makes a large loop within it. Embolus proper basally situated. Lamella characteristica (lc) relatively simple, distally drawn into a narrow, sharp-pointed tip. Terminal apophysis (ta) bipartite like in *Agyneta*.

The epigyne is of the basic Micronetinae pattern. In the ventral view the epigyneal cavity (ec) is completely covered by the proximal part of the scape (pps). The lateral walls of the epigyneal cavity have shallow depressions (dll). The scape itself is S-shaped. Its middle (mps) and distal parts (dps) are mostly buried inside the epigyneal cavity. When the epigyne is artificially extented by KOH treatment it can observed that the middle part of the scape includes a large cavity, here called atrium (at). The starting points of the entrance ducts (ed), bursae copulatrix (bc) lie on either side of the atrium. Lateral lobes (ll) fairly small with shallow lateral pockets (lp). The pit (pi) is situated at the apex of a rather long and narrow extension of the distal part of the scape.

Taxonomic position: The genus belongs the subfamily Micronetinae and is fairly close to the genus *Agyneta* (Saaristo 1973). However, the structure of the male palpal tibia readily distinguishes it from that genus. In addition the shape of the

embolus is quite different and the embolus proper (embolic tooth of Helsdingen 1978) is extremely basally situated. In the epigyne the eye-like structures (lateral lobes) on either side of the proximal part of the scape which are so characteristic of *Agyneta* are not visible because they are small and covered by the middle part of the scape. Further, in harmony with the basally situated embolus proper, the bursae copulatrix have moved to a more proximal position in the scape, lying inside a special cavity in its middle part.

Nesioneta benoiti (Helsdingen, 1978), **new combination** (Figs. 2 & 3A-F)

Meioneta benoiti Helsdingen, 1978: 889-897, f. 1-11 (male & female).
Lepthyphantes brincki Helsdingen, 1985: 18-19, f. 8 (female). **New synonymy.**
Meioneta benoiti, Helsdingen 1985: 21.

Diagnosis: The male of this species is most easily recognized by the structure of the male palpal tibia (Fig. 3A-B). Females may be recognized by the width of the scapoid base being about one third of the width of the proximal posterior edge of the scapus (Fig. 3D).

Description: The species has been well described by Helsdingen (1978).

Distribution: The species has been reported from the Seychelles and Sri Lanka (Helsdingen 1978 & 1985). It is apparently quite common in the Seychelles and found on:

Aride: 1 male, 12.03.1978, John Rowley legend (MZT AA 0.276)
Cousin: 1 female, 11.04.1978, 1 male, 12.04.1978, 2 male & female, 20.4.1978, and 1 male, 20.04.1978, Hugh Watkins legend (MZT AA 0.278, MZT AA 0.279, MZT AA 0.048 & MZT AA 0.277)
La Digue: Helsdingen (1978)
Mahé: Helsdingen (1978 & 1985)
Praslin: Helsdingen (1978)
Silhouette: Helsdingen (1978)
Petite Soeur: 1 male, 1.IX.1975, 1 male, 10.IX.1975, 1 male, 21.IX.1975, 1 male, 26.IX.1975, M. Mühlenberg legend (MRAC 177.070, MRAC 177.067, MRAC 177.068 & MRAC 177.069).

Discussion: Lepthyphantes brincki was described from a single female from Sri Lanka by Helsdingen (1985). Although he also dealt with *Meioneta benoiti* in the same paper it is clear from his figure of the epigyne of *L. brincki* (Helsdingen 1985, Fig. 8) that this species is a female of *M. benoiti*.

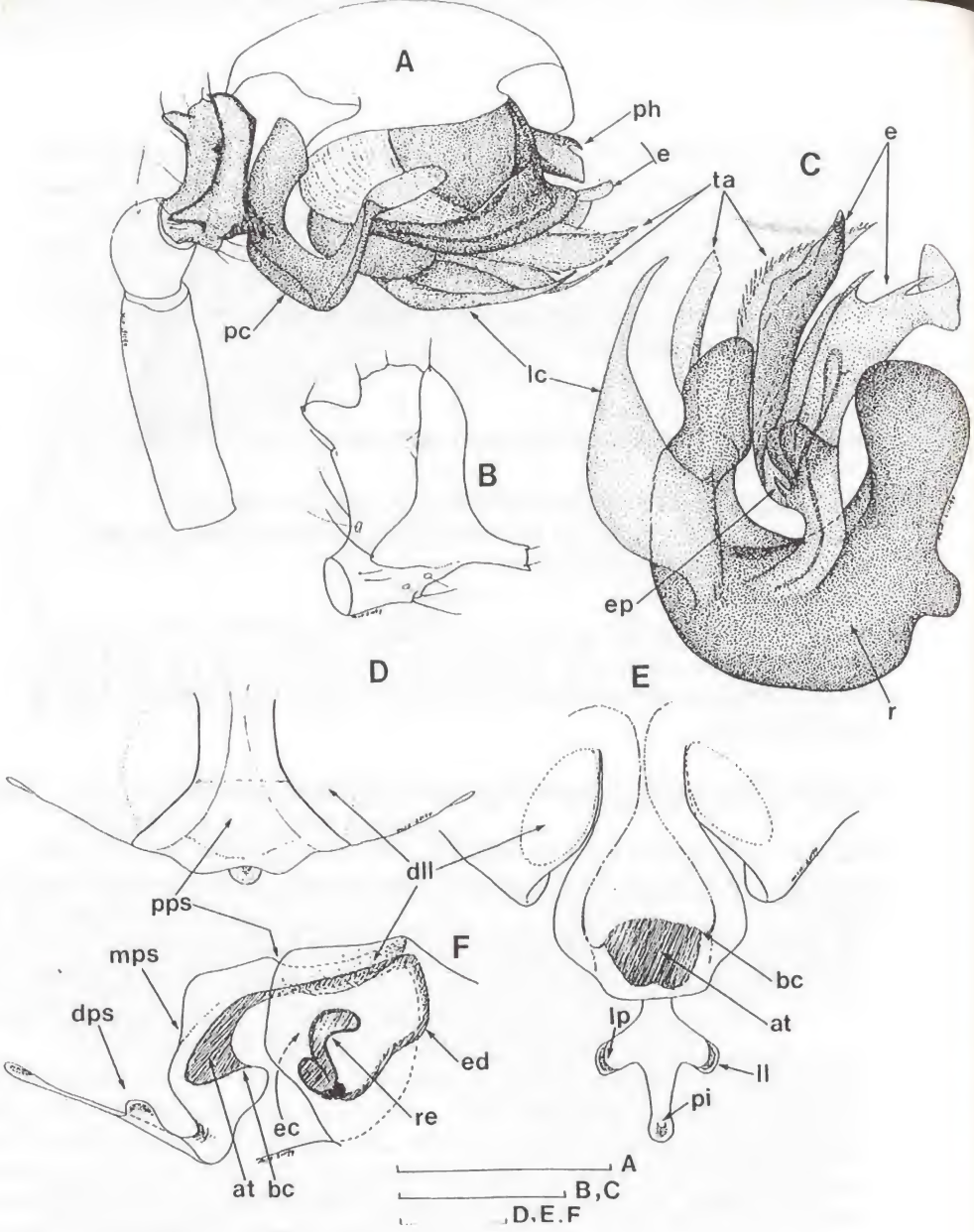

Fig. 3. *Nesioneta benoiti* (Helsdingen, 1978). Original figure, scale bar = 0.1mm. A) Right male palp ectally. B) Male palpal tibia from behind. C) Embolic division dorsally. D) Epigyne ventrally. E) Expanded epigyne ventrally. F) Expanded epigyne dextrolaterally.

It is also possible that *Nesioneta lepida* Millidge in Beatty, Berry & Millidge, 1991 is a further synonym of *M. benoiti*. The male palpal structures of *N.*

lepida figured by Millidge (Beatty, Berry & Millidge 1991, Figs. 1, 2, 4) are especially close to the corresponding parts of *M. benoiti*. The apparently distinct posterior edge of the proximal part of the scape in his figure of the epigyne (Millidge in Beatty, Berry & Millidge 1991, Fig. 3) may have been caused by distortion.

Genus *Theoa*, new genus

Type species: Theonina tricaudata Locket, 1982.

Species included: Only the type species.

Diagnosis: The genus is most easily recognized by the elaborately developed posterior part of the cymbium, combined with the large and complicated terminal apophysis.

Description: Small spiders, total length ca. 1.2 mm. Legs moderately long and slender. TmI = 0.14. TmIV absent. Chaetotaxy: TiI-IV = 1-0-0-0. No femoral or metatarsal spines.

There are no special structures in the male palpal tibia, except that it is somewhat dilated ventrally. Cymbium with tripartite posterior outgrowth and a low dorsal crest. Paracymbium (pc) with a large apical pocket. Suprategular pit hook (ph) slightly bifid. Radix (r) small in relation to other parts of the embolic division. Sperm duct with a spherical dilation inside the embolus (e) which is rather voluminous. Terminal apophysis (ta) large and extremely complicated. When the terminal apophysis is examined mesially it may be seen that in its middle there is a deeper depression (fenestra [fe]) with a weakly chitinized, translucent "floor". Lamella characteristica totally reduced.

Epigyne with pocket-like oval depressions (epo) on either side of the proximal part of the scape. Scape well developed, S-shaped. Its distal part is dilated into a shallow cup containing the bursae copulatrix (bc) and the pit (pi).

Taxonomic position: The genus *Theoa* belongs the subfamily Micronetinae and as Locket (1982) has suggested it seems to be close to the genus *Theonina* Simon, 1929. Saaristo (1974) analyzed the secondary genital organs of *Theonina cornix* (Simon, 1881), the type species of the genus. Although the male palpal structure is basically the same in *Theonina* and *Theoa*, in that both lack lamella characteristica, the separate sclerites are so different that the separation of two different genera is justified. Naturally, what is said about the male palp holds true also for the epigyne.

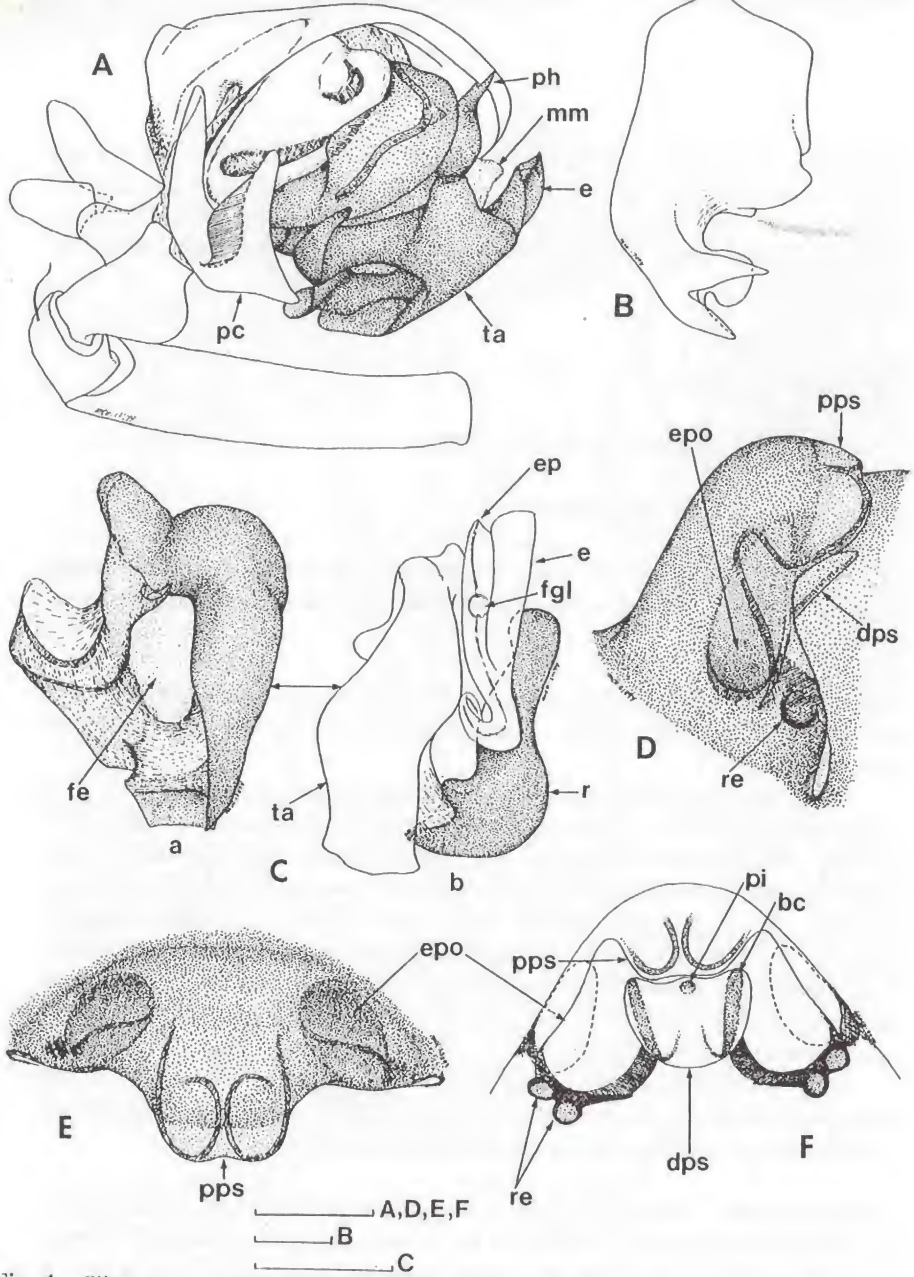

Fig. 4. *Theoa tricaudata* (Locket, 1982). Original figure, scale bar = 0.1mm. A) Right male palp ectally. B) Cymbium mesially. C) Embolic division dorsally. D) Epigyne sinistrolaterally. E) Epigyne ventrally. F) Epigyne dorsally.

Theoa tricaudata (Locket, 1982), **new combination** (Figs. 4A-F)
Theonina tricaudata Locket, 1982: 375-378, f. 80-89 (male & female).

Diagnosis: The male of this species is easily recognised by the complex, trifid cymbial apophysis (Fig. 4A-B) and the female by the structure of the epigyne (Fig. 4D-F).

Description: The species has been well described by Locket (1982).

Distribution: So far the species has been recorded only from Batu, western Malaysia (Locket 1982). It is new to the fauna of the granitic Seychelles and has been found on:

Mahé: 1 male, June 1994, and 1 female, Le Niol, *Cinnamomum* litter, 03. 08.1994, Justin Gerlach legend (MZT AA 0.287 & MZT AA 0.288).

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Clubionids of the granitic islands of Seychelles (Aranea, Clubionidae)

Michael I. Saaristo
Zoological Museum,
University of Turku,
FIN-20500 Turku, FINLAND

Key words: *Clubiona*, taxonomy

Abstract

In this paper new data on two endemic clubionids from the granitic Seychelles are presented. The female of *"Clubiona" nigromaculosa* Blackwall, 1877 is described for the first time. Figures of the genital organs of *"Clubiona" mahensis* Simon, 1893 are presented also for the first time. Their relation with the genus *Clubiona* is discussed briefly.

Introduction

The taxonomy of the family Clubionidae is still poorly done at the genus level. This is reflected by the fact that of its ca. 600 species about 2/3 are currently placed in a single genus, viz. *Clubiona*.

From the Seychelles two *Clubiona* species have been reported, viz. *Clubiona nigromaculosa* Blackwall, 1877 and *Clubiona mahensis* Simon, 1893. Of these, the first mentioned was described from a juvenile specimen. The second was originally described from a single female from Mahé. Its type seems to have been lost and accordingly Benoit (1978) designed a neotype though not from Mahé but from Praslin. Neither of these species seems to be congeneric with the type species of the genus, viz. *Clubiona pallidula* (Clerck, 1758). However, at the present no attempt has been made to place them more accurately although the generic name has been used in quotation marks to highlight the author's view that they are not members of the genus *Clubiona*. At the present, both species are know only from the Seychelles.

The female of *"C." nigromaculosa* is described here for the first time. Also, because Benoit (1978) did not present any figures of *"C." mahensis*, these are presented here.

The material treated below belongs to the following collections:
MRAC = Musée Royal de l'Afrique Centrale, Tervuren, Belgium.
MZT = Zoological Museum of Turku University, Finland.

"Clubiona" nigromaculosa Blackwall, 1877

Phelsuma 3 (1995): 53-57

Fig. 1A-D

Clubiona nigromaculosa Blackwall, 1877: 11 (immature female).
-"-, Simon 1893: 207.
-"-, Hirst 1911: 382.
-"-, Benoit 1978: 942.

Diagnosis: The female of this species may be easily recognized by the peculiar pattern on the abdomen, and the structure of the epigyne (Fig. 1A & D).

Description: Female (male unknown). Total length 7.9 mm, length of carapace 3.2mm. Cephalothorax and appendages yellowish brown. Dark markings extend from fovea up to the posterior eyes on each side of the cephalothorax. Abdomen dirty white with a complicated pattern of dark, somewhat violetish markings comprising a short median band and various dots and streaks. Chelicerae with three frontal and two posterior teeth. Of the frontal teeth the middle one is largest and from the most basal one a shallow carina extents towards the base of the paturon. The posterior teeth are small and of equal size.

Epigyne with a large, shallow transverse oval depression positioned anteriorly and fairly far from the epigastric fold. Entrance holes are present on both sides of the posterior margin of that depression.

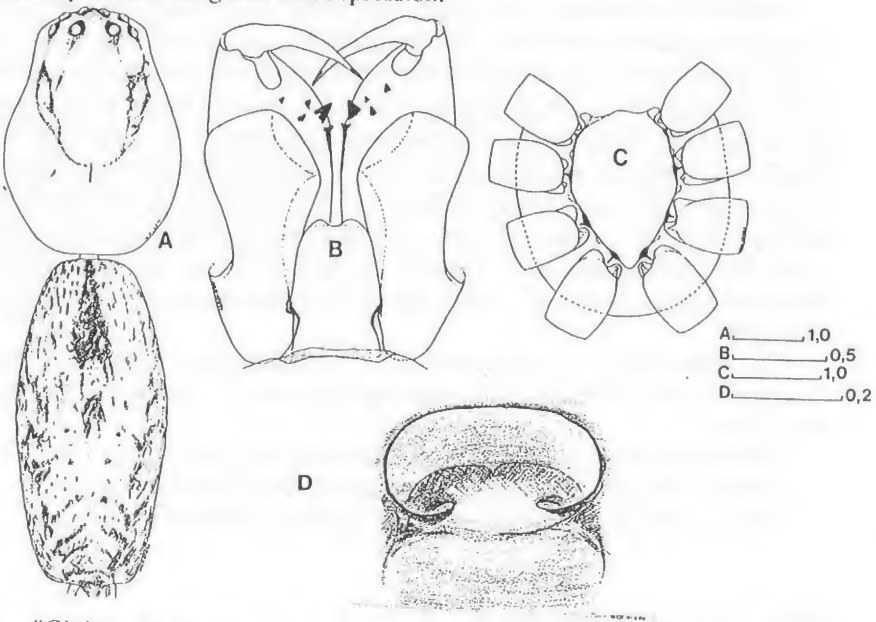

Fig. 1. *"Clubiona" nigromaculosa* Blackwall, 1877. Original figure (scale bar length in millimetres).
A) Dorsal view of the female. B) Chelicerae, maxillae and labium posteriorly. C) Sternum and coxae ventrally. D) Epigyne ventrally.

Distribution: The species was originally described from a juvenile specimen and its exact locality is unknown. It is now known from:

Anonyme: Hirst (1911)
Aride: 1 juv., 1975, Mühlenberg legend (MZT AA 0.087)
Cousin: 2 juv., Mar/Ap. 1978, Hugh Watkins legend (MZT AA 0.085 & 0.086)
Mahé: Simon (1893)
Silhouette: 1 female, *Pisonia* forest, 1990, Justin Gerlach legend (MZT AA 0.084).

Discussion: According to Benoit (1978) both Simon's and Hirst's material of this species have been lost. However its type, a juvenile specimen, is still in existence and preserved at the Hope Department of Entomology, University of Oxford: Bottle 290, Tube 9.

"Clubiona" mahensis Simon, 1893
Fig. 2A-D

Clubiona mahensis Simon, 1893: 207 (female).
-"-, Hirst 1911: 382.
-"-, Benoit 1978: 943 (female neotype & male allotype).

Diagnosis: The specimens of this species may be easily recognized by characters of the genital organs (Fig. Aa, Ab & B) and the dentition.

Description: Total length ca. 4.4 mm; carapace length 2.0 mm. Carapace and chelicerae pale yellowish; legs and abdomen dirty white. Chelicerae of female projecting forwards; armed with one large, one smaller and three minute denticles in the frontal row and with 2-3 smaller ones in the posterior row; chelicerae of male nearly vertical. Clypeus very low.

Male palp with an unbranched tibial apophysis. Embolus short, claw-like. Structure of the epigyne difficult to determine but there seem to be small pocket-like structures associated with the entrance holes. Short ducts run from the entrance holes to the fairly large oval shaped receptaculae.

Distribution: The species is known from:

Mahé: Roche Caiman Bird Sactuary, 1female subadult, 23.12.1993, Justin Gerlach legend, (MZT AA 0.308); Simon (1893) and (Hirst 1911)
Praslin: Benoit (1978): female neotype & male allotype (MRAC 143.110),
Silhouette: Hirst (1911) and Benoit (1978): 1 male (MRAC 143.157).

The earwig *Chaetospania gardineri* (Burr, 1910) rediscovered

Pat Matyot
PO Box 321, SEYCHELLES

Key words: Dermaptera, Seychelles, Insecta, Mahé, Silhouette,

Abstract:

The earwig *Chaetospania gardineri* (Burr, 1910) has been rediscovered on Silhouette and Mahé islands, Seychelles. The historical background to the feared extinction of the species is summarised and details of two recent sightings are given, together with notes on threats to *C. gardineri*, one of which could be another earwig, the introduced *Chelisoches morio* (Fabricius, 1775).

Introduction

The earwig *Chaetospania gardineri* (Burr, 1910) was described under the name of *Sparatta gardineri* by Burr (1910), who studied the 47 specimens collected by Scott in August-September 1908 on the island of Silhouette and in December 1908 - February 1909 on Mahé during the second Percy Sladen Trust Expedition to Seychelles. Later, Burr (1911) moved the species to its present generic placement under *Chaetospania*. As Table 1. shows, Scott found almost equal numbers of males and females.

Table 1. Numbers of males and females of *C. gardineri* collected by Scott in each locality (compiled from locality data in Burr (1910) and Scott (1910)).

Locality	males	females
Silhouette[1]	4	7
Mahé[2]	21	15
Total	25	22

[1] highest forest, 450m and above; forest near Mare aux Cochons, over 400m

[2] forest between Trois Frères and Morne Seychellois, 450-600m; forest above Cascade Estate, 300-600m; near Morne Blanc over 400m.

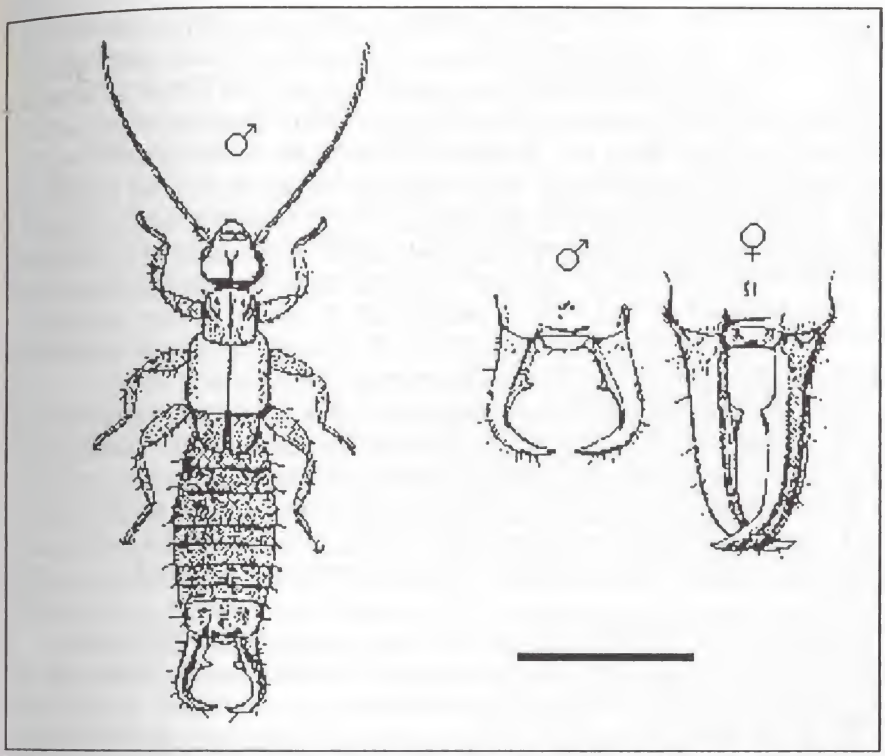

Fig. 1. *Chaetospania gardineri*, whole animal (male) and details of male and female cerci. After Burr (1910)
Scale bar: whole animal = 10mm, cerci = 2mm

According to the locality data accompanying Burr's description, Scott found *C. gardineri* at altitudes of 300-600 metres. Some specimens were collected from the leaf bases of a felled and decayed *Verschaffeltia splendida* Wendland, 1865 palm and from the leaf bases of growing *V. splendida* and *Phoenicophorium borsigianum* (Koch) (known to Scott as *Stevensonia grandifolia*) palms, but no details regarding habitat are given for the remaining specimens. Both species of palm are endemic to the Seychelles islands.

In a separate account Scott (1910) mentions that "numbers of small Forficulidae with white tegmina were found between the leaf bases of *Verschaffeltia* palms" - obviously a reference to *C. gardineri*, whose whitish elytra are a striking feature, although the genus *Chaetospania* actually belongs to the Spongiphoridae (=Labiidae) (Rentz & Kevan 1991).

The same report by Scott also provides useful meteorological data. Scott collected *C. gardineri* on Silhouette in August-September 1908 during the season of the south-east trade winds: "that is to say, in the coolest and driest time of the year.

On the whole the weather was fine, though broken by some wet spells, and often by short rain-storms". His Mahé specimens were collected during the north-west monsoon: "The season was that in which most rain is expected, and from December 19 to December 30 the sun was scarcely to be seen at all at Cascade. There was also heavy rain at other times. . ." Reporting further on the insects found living between the leaf bases of palms and screw-pines (*Pandanus* spp.), Scott (1932) mentions "*Sparatta*" (=*Chaetospania*) *gardineri* as the only representative of the Dermaptera found in this habitat, and he again names *P. borsigianum* and *V. splendida* as the plants on which it was found. It is interesting to note that in Scott's list, *C. gardineri* is not marked with the asterisk that he uses to indicate species found exclusively in leaf axils. This suggests that he found *C. gardineri* in other habitats as well, but there is no further information regarding this.

Brindle (1976) points out that sixty-three years after the Percy Sladen Trust Expedition, Benoit and Van Mol of the Mission Zoologique Belge of 1972, organised by the Musée Royal de l'Afrique Centrale in Tervuren (Belgium), failed to find any specimens of *C. gardineri*. He also casts doubt on a record (Borelli 1932) of *C. gardineri* from Borneo, and suggests that the record of *Platylabia major* Dohrn 1867 collected on Mahé in 1892 by Alluaud (Bormans 1895) could refer to *C. gardineri*.

Floater (1994) provides the most recent review of Seychellois Dermaptera. He notes that the Oxford University Expedition to Silhouette in 1990 and subsequent searches in 1991 failed to find *C. gardineri*.

The recent rediscovery of the species, eighty-six years after it was last collected by Scott, should be of considerable interest to Dermapterists and others who had been fearing its possible extinction.

Recent sightings

C. gardineri was rediscovered during a visit to Silhouette on December 11th 1994. A female was found in one of the leaf axils of a young *V. splendida* palm growing beside the lower path between La Passe and Grand Barbe, at approximately 370 metres above sea level, in the area between the ridge pointing towards Mont Laurent and the Mont Corgat - Gratte Fesse ridge. The leaf in question was the first one on the outside. It was dying and had started to turn brown although it was not quite dead.

Just over a month later, on January 15th 1995, a male was discovered in one of the leaf axils of a young *Nephrosperma vanhoutteana* (Wendland, 1865) palm, also endemic, in the vicinity of the large pitcher plant (*Nepenthes pervillei* Blume, 1852) patch on Mont Coton on Mahé, at around 500 metres altitude. The leaf, again the first outer one, was this time quite dead and had started to rot.

In both cases *C. gardineri* was found not in the upper part of the leaf axil, where there was an accumulation of organic debris, but lower down under the sheathing base of the leaf, where it clasps the trunk tightly. Further work is required

to determine if *C. gardineri* is actually much rarer than at the time of the second Percy Sladen Trust Expedition of 1908-1909, as suggested by Brindle (1976) and Floater (1994), or if it eluded later collectors because they did not investigate its habitat properly. Scott "devoted special attention to this milieu and its inhabitants, often felling trees and cutting off the sheathing leaf bases one by one, from the outermost inwards, carefully collecting every visible form of animal life found between them" (Scott 1932). It is possible that later collectors were not as perseverent and meticulous - but reluctance to sacrifice endemic palms may have been a consideration.

Threats to the species

Further disturbance of the native palm forests of Mahé and Silhouette, already considerably altered by tree-felling, forest fires and the introduction of exotic plants, will obviously affect the remaining populations of *C. gardineri*. The effect of introduced insects and other animal species needs to be investigated. Floater (1994) drew attention to the apparently recent colonisation of palm leaf bases at Bel Ombre on Mahé by the introduced earwig *Chelisoches morio* (Fabricius, 1775). There is the worrying possibility that *C. morio* may prey on *Chaetospania gardineri* and compete with it for egg-laying and resting sites.

In 1994, *Chelisoches morio* was discovered in the leaf axils of *N. vanhoutteana* palms on the cliff at Ma Josephine in La Misère district on Mahé. This species certainly seems to be extending its range. It has also been observed, mainly in anthropophilic situations, at Marie Laure Estate in Bel Ombre district; at Hermitage in Mont Fleuri district; and at Fairview Estate in La Misère district, all on Mahé. The first Percy Sladen Trust Expedition, in 1905, had found *C. morio* only on the outlying coral island of Farquhar, and it was apparently not collected by the second expedition in 1908-1909 (Burr 1910).

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Keys to the Seychelles Fauna
1. Holothyrid giant mites

J. Gerlach

A characteristic component of the Seychelles montane forest fauna are the giant mites belonging to the family Holothyridae. These are approximately 8mm in diameter and have a total leg span of over 10mm, making them the world's largest mites. All the Seychelles species are endemic although the family is also found in Mauritius and Australasia (Thon 1906).

In addition to their large size these mites are notable for their remarkable adaptation to a predatory life. They have modified the typical mite feeding stylets into a rasping radula. This character, normally considered characteristic of molluscs, is probably used to bore holes through arthropod exoskeletons. The precise details of their feeding mechanism remains obscure as nothing is known of their ecology.

There are four Seychelles species with the following distributions:

Holothyrus braueri Thon, 1906	Silhouette & Mahé
H. gardineri Warburton, 1912	Mahé
H. niger Thon, 1906	Silhouette
H. seychellensis Thon, 1906	Silhouette

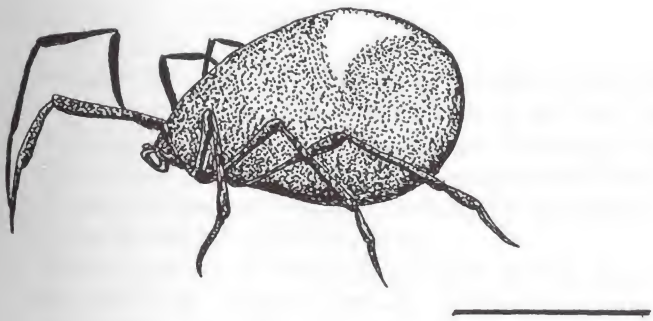

Fig. 1. *Holthyrus niger*. Scale bar =5mm

NOTES

Full descriptions are given by Thon (1906) and Warburton (1912), the former with a detailed account of the morphology, including the radula and musculature. The main characters used to distinguish the sepecies are those of the structure of the genital plate of the abdomen. The key below uses external body colour as an easily used means of distinguishing the species. Two species are not separable on colour but available data indicates that they are found on separate islands.

Key:

1.	Back colour -	black	2.
		red, tarsii white	*H. braueri*
2.	Tarsii colour -	black	*H. niger*
		white	*H. gardineri* (Mahé)
			H. seychellensis (Silhouette)

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NOTES

New records of *Seychellaria thomasetti*

M. Kirkpatrick
Anse Royale Hospital,
Anse Royale, Mahé,
SEYCHELLES

In 1994 I found *Seychellaria thomasetti* Hemsley, 1907 at three new locations - each time in the company of Pat Matyot. These are described below:

Mahé

map ref.: Mahé 3 27/5 86/9

Date - 28/8.94

Found at 600m on the east-facing slope of Morne Seychellois, in damp *Pandanus sechellarum* Balfour, 1877 leaf litter

map ref.: Mahé 2 21/8 88/3

Date - 2/1/95

Found at 300-320m on the bluff behind Mt. Jasmin, facing towards Anse Major. Growing beneath *Phoenicophorium borsigianum* (Koch) in minimal leaf litter on rocky terrain. This was predominantly the white form (Gerlach 1994) but darker "normal" purple forms were also present. This seems to be in the same area reported by J. Collie & K. Fleishmann in August 1993 (Nature Protection Trust of Seychelles 1993) but as the terrain is so difficult I find it unlikely that it is the same, and only, patch.

Praslin

map ref.: Praslin 3 20/4 60/6

Date - 17/9/94

Found at 367m looking W250S towards Grosse Roche, St Sauvenir. Under two *Cinnamomum verum* Presland trees, in leaf litter and seedlings in a cool rock-shaded area 2×2m with some *Hypoxidia rhizophylla* (Baker, 1877) but no palms or *Pandanus*. Abundance may be due to unduly wet 9 weeks preceding; only found in this one spot and definitely not in evidence in March 1994 on my previous visit.

Further evidence of the biological value of this sites at Fond Azore is provided by the animal life present. Among the insects observed flying in the vicinity that day were the "skipper" butterfly *Coelades forestan* (Cramer, 1782) and the scarabaeid beetle *Perissosoma grande* (Scott)

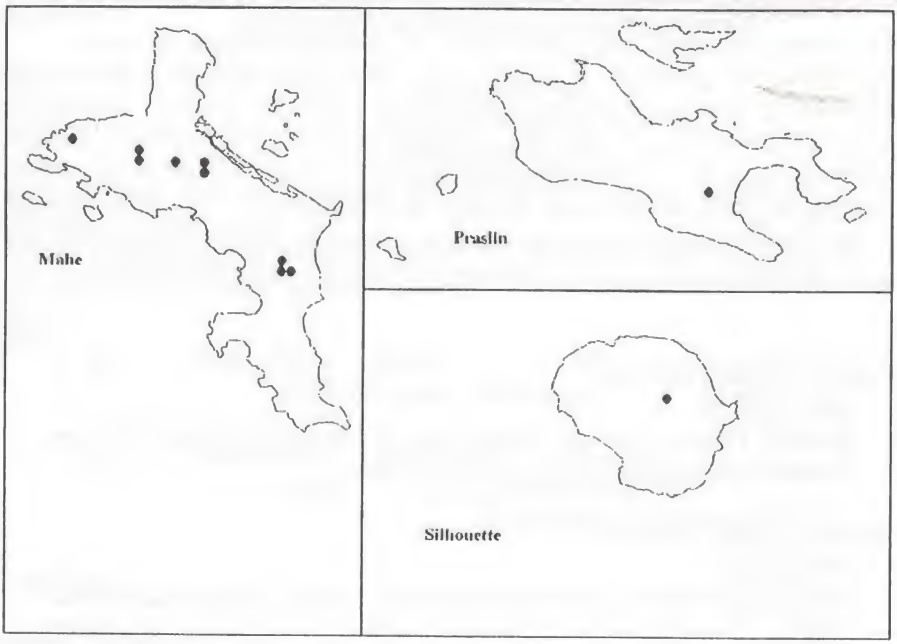

Fig. 1. Distribution of *Seychellaria thomasettii*

The Praslin record is the first for that island. The growth of *Seychellaria thomasetti* in the absence of palm or *Pandanus* litter on Praslin disproves the suggestion that the species is only found in association with *Pandanus sechellarum* (Robertson 1989).

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NOTES

18th Century records of the natural history of Seychelles

J. Gerlach
PO Box 207, Victoria, Mahé,
SEYCHELLES

Collections of plants and animals from Seychelles date from the mid 1800s and include a variety of both native and introduced species. The lack of specimens predating settlement of the islands causes problems in distinguishing introduced species from the native component. This problem is particularly important in understanding the biogeography of the islands and in undertaking conservation measures. Habitat restoration, in particular, requires a reasonable estimate of the 'natural' habitat that is desired. A way around this problem may be provided by a consideration of the historical records relating to the islands. Some of the early expeditions to Seychelles provided tolerably useable descriptions of the flora, fauna and habitats they encountered. Of particular interest in this respect are the accounts from the 18th century. These comprise the observations of Picault and Grossin in 1742, Morphey in 1756, the Marion Dufresne expedition of 1768, Du Roslan in 1771, Gillot in 1772, Dennis de Trobriand in 1773 and De Bouganiville and Brayer du Barre in 1775 quoted in Fauvel (1909).

These observations are compiled below into an overview of the 18th century nature of Seychelles. Where identifications are not self-evident from the original text the interpretations given by Lionnet (1983) for the Marion-Dufresne records are followed, modifications to these interpretationsa are explained below.

Mahé

The coasts of Mahé were fringed with *Cocos nucifera* Linnaeus, 1753 with local areas of mangrove swamps and small numbers of *Casuarina equisetifolia* Linnaeus, 1759, *Thespesia populnea* (Linnaeus, 1753) and *Cordia subcordata* Lamarck, 1791. Around the coasts both green turtles (*Chelonia mydas* Linnaeus, 1758) and hawksbill turtles (*Eretmochelys imbricata* Fitzinger, 1843) were present in large numbers, as were the crocodiles (*Crocodylus porosus*). Tortoises (*Geochelone* spp.) were present but only in small numbers in coastal forest.

Lowland forests away from the coast was characterised by an absence of undergrowth. Palms were abundant (*Deckenia nobilis* Wendland, 1877, *Phoenicophorium borsigianum* (Koch), and *Vershaffeltia splendida* Wendland, 1865, although *Cocos nucifera* were absent). Other common trees included *Calophyllum inophyllum* Linnaeus, 1753, *Terminalia catappa* Linnaeus, 1767, *Heritiera littoralis* Ait., 1789, *Ochrosia oppositifolia* (Lamarck), *Mimusops sechellarum* (Oliv., 1916), *Ficus* spp., *Syzygium wrightii* (Baker, 1877), *Vateriopsis seychellarum* (Dyer, 1877) and *Drypetes riseleyi* (Shaw). Less common were *Pisonia grandis* (Br., 1810), *Brexia madagascariensis* Thouars, *Intsia bijuga*

(Colebr.), *Dillenia ferruginea* (Baillon, 1866), *Diospiros seychellarum* (Hiern, 1873) (locally common) and *Pandanus* spp.

High altitude forests were dominated by *Northia hornei* Hartog, 1879. Tortoises were more abundant in the lowland forest than along the coast. Fruit bats (*Pteropus seychellensis* Milne-Edwards, 1885), tree frogs *Tachycnemis seychellensis* and the Seychelles wolf snake *Lycognathophis seychellensis* were present as were large scorpions (*Chiromachus ochropus* (Koch, 1838)). The Mascarene frog *Ptychadena mascariensis* (Dumeril & Bibron, 1834). was restricted to lowland swamps. Invertebrates included unidentified blue flies, abundant millipedes, ants, caterpillars and the fire fly (*Luciola laeta* Gerlaecker, 1871). Common birds included turtle doves (*Streptopelia picturata* (Temminck, 1815), blue pigeons (*Alectroenas pulcherrima* (Scopoli, 1768)), kestrels (*Falco araea*), sunbirds (*Nectarinia dussumieri* (Hartlaub, 1877)), flycatchers (*Terpsiphone corvina* (Newton, 1867)), green parakeets (*Psitacula wardii* (Newton, 1867)., bulbuls (*Hypsipetes crassirostirs* Newton, 1867), moorhens (*Gallinula chloropus* (Linnaeus, 1758)), galinules (*Porphyrio* sp.) and black parrots (*Coracopsis nigra* (Linnaeus, 1766)). There were small numbers of warblers (*Acrocephalus sechellensis* (Oustalet, 1877)) and Madagascar fodies (*Foudia madagascariensis* Bonaparte, 1850) (see Gerlach & Gerlach 1994 for a discussion of this identification). Sea-birds present around the coast (but not necessarily nesting) included terns, boobies (*Sula* spp.) and frigates (*Fregatta* spp.). Three species of uncertain identification were also recorded; 'bengalis' may have been either fodies or waxbills (*Estrilda astrild* (Linnaeus, 1758)) (Gerlach & Gerlach 1994), 'loriots' (orioles) and 'pies de la petite especes' are unidentified (all are recorded by Malavois in 1787).

Freshwater fish were abundant, comprising several estuarine species, freshwater eels (*Anguila bicolor*) and *Pachyplanchax playfairi* Gunther in the mountain streams. The lists of fish given include a large species (up to 30cm long) in freshwater away from the estuaries, these could be tilapia (*Oreochromis mossambicus* (Peters, 1852)) although there are no published records of the species until 1974 (High 1974) which would indicate that it was not present until the middle of the 20th century.

Intermediate forest was dominated by *Mimusops sechellarum*, with many *Drypetes risleyi*. Other trees were uncommon (*Syzygium wrightii, Brexia madagascariensis, Vateriopsis seychellarum., Ficus* spp. *Diospiros seychellarum, Dillenia ferrugiena, Deckenia nobilis, Phoenicophorium borsigianum, Versaffeltia splendida* and *Pandanus* spp.). Animal life in this forest type included tree frogs, skinks and the chameleon *Chamaeleo tigris*.

The islands off the east coast of Mahé (Anonyme, Cerf, Long, Moyenne, Round, St Anne and South-East) were characterised by a uniform flora and fauna. Vegetation was predominantly of the coastal/lowland type with small numbers of *Cocos nucifera* along the beaches and much *Calophylum inophyllum*. Behind the beach crest trees included *Mimusops seychellarum, Drypetes risleyi., Syzygium*

wrightii, *Ficus* spp., *Terminalia catappa* and *Adenanthera pavonina* Linnaeus, 1753. The endemic palms *Phonicophorium borsigianum*, *Versaffeltea splendida* and *Deckenia nobilis* were also present, the first two were very abundant but the latter scarce. A large species of sedge or grass was also present.

The fauna included tortoises, crocodiles and turtles on all the islands. Large numbers of land-birds were present including turtle doves, blue pigeons, bulbuls, Madagascar fodies, black parrots, green parakeets and magpie robins (*Copsychus sechellarum* Newton, 1867). Fruit bats, *Mabuya* skinks and *Phelsuma* day geckos (species not identified) were all present. A range of invertebrates were noted including slugs (Veronicellidae presumably), woodlice, mosquitos, butterflies, caterpillars, ants and bees (*Megachile* sp. and *Sceliphron violaceum*). Centipedes (including *Scolopendra subspinipes*) were abundant. The largest and highest of these islands, St. Anne, supported a number of species that were not recorded on the other islands. These included giant millipedes (*Sechelleptus sechellarum*) and a number of plants; *Rhipsalis baccifea* (Soland), *Ochrosia oppositifolia*, *Vateriopsis seychellarum* and *Dillenia ferruginea*. *Casuarina equisetifolia* and *Thespesia populnea* were reported on Cerf only.

Small rocky islands shared much of their limited nature; Mamelles supported 20 'vaches marines' in 1768, boobies (*Sula* spp.), tropicbirds (*Phathon lepturus* Lácèpede & Daudin, 1802), common noddies (*Anous stolidus* (Linnaeus, 1758), shearwaters (*Puffinus* sp.) and 100 tortoises. The identification of the 'vaches marines' as seals (Stoddart 1972) is undoubtedly correct, it is not possible to identify the species precisely but the descriptions appear to refer to a fur seal, on present distribution this is most likely to have been *Arctocephalus pusillus*. The only trees present were *Pisonia grandis*. Seche also supported tortoises (30 in 1768) but its flora cosisted of *Euphoriba pyrifolia* Lamarck and *Cyperus* sp. Isle aux Vaches Marines was also inhabited by seals.

Praslin group

The small sea-bird islands of the Praslin group have always had a flora characterised by its low diversity. In 1787 only *Pisonia grandis* was recorded on Aride, Cousin and Cousine. The only animals recorded were tortoises on Aride.

The larger islands were more diverse. Curieuse supported very little forest in 1768 when small numbers of coco-de-mer *Lodoicea maldivica* (Gmelin, 1807), *Cocos nucifera* and *Casuarina equisetifolia* were recorded, with some other palms (species not recorded). Tortoises were scarce. The wolf snake was recorded as being present.

Felicite was similarly poorly wooded in 1768, although *Mimusops seychellarum* and *Calophyllum inopyllum* were recorded in 1787. Tortoises were present. Marianne supported no forest at all, being described as merely rocks and scrub with some tortoises present.

La Digue exhibited the typical vegetation zonation of the larger islands with a littoral fringe of *Cocos nucifera* and forest on the hills, this was

predominantly *Calophyllum inophyllum* and *Mimusops seychellarum*. Tortoises were abundant.

Praslin was poorly wooded for the most part. The coasts were fringed with *Cocos nucifera* with some *Casuarina equisetifolia*. Hills were dominated by *Lodoicea maldivica, Decekenia nobilis* and *Phoenicophorium borsigianum*. A few trees of *Vateriopsis seychellarum., Mimusops seychellarum* and *Terminalia catappa* were present. The only non-palm dominated forests were in the south-east where *Ochrosia oppositifolia* and *Terminalia catappa* were abundant, with some *Lodoicea maldivica*. There were small numbers of *Vateriopsis seychellarum., Mimusops seychellarum* and *Trilepisium madagascariense*.

Birds recorded on Praslin were turtle doves, magpie robins, black parrots, green parakeets, bulbuls, white-eyes (*Zosterops semiflava* Newton, 1867), ducks (probably the migratory garganey *Anas querquerula* Linnaeus, 1758) and moorhens. There is also one unidentified species, the 'poule pintade' which could be a species of rail. Fruit bats, hawksbill turtles, crocodiles and tortoises were also recorded, the latter in small numbers. Freshwater life included eels and fish.

Silhouette group

There are few observations for the Silhouette group. North was completely destroyed by fire before its first description in 1787 when tortoises were reported to be present. Silhouette's coasts were sparsely fringed by *Cocos nucifera, Casuarina equisetifolia* and *Calophyllum inophyllum*. Crocodiles and turtles were reported to be more abunant than on other islands. Tortoises were present as were flies, ants and 'brown caterpillars'.

Fregate group

Unlike most of the other islands Fregate did not have a coastal fringe of *Cocos nucifera* in the late 1700s. The main forest was dominated by *Pisonia grandis*. Tortoises and seals were present. Recif was not wooded although described as 'verdant'. There were seals and some tortoises.

Outer islands

Tortoises were recorded on most of the outer islands (Alphonse, Farquhar, Bird, Denis and Desroches). Other animals included fur seals on Bird, turtles on Denis and large numbers of birds (presumably tern colonies) on Denis and Farquhar. Vegetation was predominantly *Pisonia grandis* (Bird, Coetivy, Denis, Desroches and Farquhar) with some *Cocos nucifera* (Coetivy and Desroches) and *Casuarina equisetifolia* (Desroches).

These observations confirm that the 'natural' habitats of the islands were densely forested high islands with fringes of coastal vegetation. Islands of the Praslin group contained a high proportion of palms and the smaller islands were predominantly sea-bird/seal islands with a poor flora dominated by *Pisonia grandis*.

NOTES

The forests of the higher islands were notably different from their present day composition in the predominance of *Mimusops seychellarum* and *Vateriopsis seychellarum*, both now very rare trees. Most interesting are the species that were recorded on the different islands. These include plants that have been categorised as introduced (*Adenanthera pavonia*) or restricted to a single island (*Vateriopsis seychellarum*). Of the animals recorded the presence of giant millipedes on St. Anne is noteworthy as is the presence of the wasp *Sceliphron violaceum* which has been considered to be an introduction. The birds appear to have been more or less uniformly distributed between the islands with both parrot species recorded in both the Mahé and Praslin groups, as were the flycatcher, magpie robin and brush warbler. The presence of several unidentified species of birds is further evidence of the incompleteness of our knowledge of the original Seychelles avifauna.

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A Visit to Isle aux Vaches Marines

R. Gerlach,
PO Box 207, Victoria, Mahé,
SEYCHELLES

On 28/5/94 Adrian Skerrett and I visited Isle aux Vaches Marines which is a small (4.7 hectares) rock island situated off the south-west coast of Mahé. We were looking for the presence of breeding seabirds and passed close to Conception and Therese where there were no signs at all. There were many seabirds as we approached Isle aux Vaches Marines, mostly common or brown noddies (*Anous stolidus* (Linnaeus, 1758) and a few bridled terns (*Sterna anaethetus* Scopoli, 1786). We estimated that there were approximately 2000 noddies on the island and many had eggs. The brideld terns were seen on the wing and there was no sign of any nesting activity although the terrain is ideal for them.

The island is a granite outcrop and as such has no soil. It has however been used by seabirds and has been colonised by some plants. Of these the *Ficus* have grown int fairly substatnial trees up to 3m high. This island has rarely been visited previously and there are few published records of its flora and fauna.

Land animals included Seychelles skink (*Mabuya sechellensis*), giant millipedes (*Sechelleptus seychellensis*) and the shed skins of the rock crab *Grapsus tenuicrustatus* . The presence of giant millipedes is notable as these have not been recorded on the island previously. Skinks were recorded by Vesey-Fitzgerald (1947) but in the 1950s only *M. wrightii* were noted. These were not seen on this visit which suggests that *M. sechellensis* has replaced the larger sea-bird associated species.

Of the plants *Ficus reflexa* Thunberg and *Ficus avi-avi* Blume were all over the island in crevices but were mostly scattered. A small clump was present on the top plateau with *Cocos nucifera* Linnaues, 1753. There were several clumps of grass and sedge (Graminae: *Pennisetium polystachyon* (Linnaeus, 1753), *Stenotaphrum micranthum* (Desv.); Cyperaceae: *Marisucs dubius* (Rottb.), *Mariscus ligularis* (Linnaeus)). The fern *Nephrolepis* cf. *biserrata* was present under the fig trees. *Lippia nodiflora* (Linnaeus, 1753) and *Pentodon pentandus* (Schumacher & Thonn.) were present. *Sarcosemma viminale* Br., 1810 was only seen on rocks near the shore. Specimens were collected of the following species; *Mariscus dubius, Pennisetium polystachyon, Stenotaphrum micranthum, Pentodon pentandus, Marisus ligularis, Sarcostemmna viminale, Ficus avi-avi, F. reflexa* and an unidentified shrub. All are in the collection of the NPTS. The plant list is compared to the collections made by Sauer (1967) and Frazier & Feare in 1973 (Robertson 1989) in Table 1.

Table 1. Plant lists for Isle aux Vaches Marines

	1967	1973	1994
Cocos nucifera	+	+	+
Paspalum vaginatum	+	+	-
Pennisetium polystachion	-	-	+
Stenotaphrum micranthum	+	+	+
Mariscus dubius	-	-	+
Mariscus ligularis	+	+	+
Nephrolepis biserrata	-	-	+
Lippia nodiflora	-	-	+
Ficus avi-avi	+	+	+
Ficus reflexa	-	+	+
Pentadon pentandrus	+	+	+
Sarcostemmna viminale	+	+	+

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Mariscus dubius	-	-	+
Mariscus ligularis	+	+	+
Nephrolepis biserrata	-	-	+
Lippia nodiflora	-	-	+
Ficus avi-avi	+	+	+
Ficus reflexa	-	+	+
Pentadon pentandrus	+	+	+
Sarcostemmna viminale	+	+	+

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NOTES

Sightings of the sheath-tailed bat *Coleura seychellensis* Peters, 1868 (Chiroptera: Emballonuridae)

Pat Matyot,
PO Box 321,
SEYCHELLES

Summary: A small bat, believed to be *Coleura seychellensis*, has been observed in flight in the Bel Ombre district on Mahé island, Seychelles. Accounts of the presence of the bat on Silhouette, obtained from past and present inhabitants of the island, are given.

Introduction

The last published accounts of observations on the endemic sheath-tailed bat *Coleura seychellensis* Peters, 1868 of Seychelles are those of Nicoll & Suttie (1982) and Racey & Nicoll (1984). Both reports give only Praslin and La Digue islands as localities where the species has been observed form 1972 to 1980. There are no recent first hand accounts of sightings of the species on Mahé and Silhouette.

Sightings on Mahé

Sightings of a very small bat, presumably *C. seychellensis*, in flight in one locality on Mahé in 1993 and 1994 suggest that the species may still roost on Mahé as well. The only other species of bat that is known to occur in the granitic islands of Seychelles is the fruit bat *Pteropus seychellensis* Milne Edwards, 1887 (Chiroptera: Pteropodidae) and the specimens on which this account is based were definitely not of that species. One specimen at a time was sighted on several occasions, but the animal was not recognised to be a bat at first and the dates of the first sightings were not recorded. Also, the pressures of other work did not permit the recording of all sightings even when *C. seychellensis* was suspected. Those dates that were recorded are as follows; 2nd August 1993; 7th August 1993; 8th August 1991; 9th August 1993; 10th July 1994; 28th September 1994; 2nd October 1994.

The locality in question is a drive leading to a house in Marie Laure Estate (=Mount Simpson Estate) in Bel Ombre district. It is 42 metres long and slopes from 95 metres altitude at its upper end to 85 metres altitude at its lower end. The drive is bordered on both sides by trees, mainly *Pterocarpus indicus* Willd. 1809, *Paraserianthes falcataria* (Linnaeus, 1753), *Cinnamomum verum* Presl. *Alstonia macrophylla* Wall. and *Hevea brasiliensis* Willd. 1809. The branches on either side meet above the drive, creating a thin layer of foliage overhead.

Each time, one single bat was observed flying rapidly up and down the drive, veering occasionally from side to side, as low as 1.5-2 metres above the ground. A rustling sound, probably produced by the rapid beat of wings, as well as what may be described as occasional bursts of stridulation-like sound, presumably

an audible component of the sound emitted by the bat for echo-location, could clearly be heard. The to and fro flight continued even when the bat was illuminated by a torch. A considerable number of small insects, including various unidentified micro-moths, were observed fling about a short distance from the ground, it is possible that the bat was feeding on them. Most of the sightings were made at between 10pm and midnight, the flights lasted for as long as the bat was watched; usually for about half an hour. In one case, on 7th August 1993, the bat was observed in flight between 11.30pm and midnight, but was no longer there when a further check was made later at 1am. On 8th August 1993 it was seen at around midnight but vanished when a moderate wind arose about 15 minutes later.

Nicoll & Suttie (1982) suspected *C. seychellensis* to fly "with relatively little manoeuvrability" and also referred to its supposedly "high-flying tendencies". The way the bats observed navigated very precisely back and forth within the confines of the "corridor" of the drive and surrounding trees, at the low height indicated above, suggests otherwise.

Racey & Nicoll (1984) confirm that all known roosts of *C. seychellensis* are inside boulder caves. Cliffs and boulders abound in the vicinity of the drive, but preliminary searches have not uncovered any roosting sites.

Accounts of *C. seychellensis* on Silhouette

There are very few published accounts of *C. seychellensis* on Silhouette. Recent attempts to locate roosts at Gratte Fesse have not been successful (Oxford University Silhouette Expedition 1990). Nicoll & Suttie (1982) quote Beckett as reporting that on that island, *C. seychellensis* "is seen most often during bad weather, when it forages in the settlement areas, occasionally entering buildings". In view of the lack of information on the distribution and habits of *C. seychellensis* on Silhouette, it was decided to conduct interviews with present inhabitants of Silhouette with persons who lived island, to find out if they had observed *C. seychellensis*, which is known as "sousouri bannann" (literally "banana bat") in the Seychellois Creole language.

Three interesting accounts were obtained. An eighty-three year old man who lived on Silhouette in the 1930's reported seeing *C. seychellensis* in a boulder care above Anse Mondon in the north of the island. He claimed that one had to be careful when entering the cave because as the disturbed bats flew out they could inflict scratches with their claws. The same informant said that kestrels "and other birds of prey" attacked the bats when they left the cave.

A sixty-six year-old man who lived on Silhouette from 1949 to 1968 reported seeing large numbers of *C. seychellensis* huddled together in a cave above a swamp called "Merkir" (spelt as pronounced) at Grande Barbe on the western side of the island.

Finally, a fifty-one year old man who has lived on Silhouette all his life reported having observed *C. seychellensis* flying around at La Passe, on the eastern

side, shortly before sunset in rainy weather, especially during the north-west monsoon. He added that the bats occasionally roosted in dark corners of the ceiling of the "Grande Case", once the residence of Dauban family, the former owners of Silhouette.

Logistical constraints did not make it possible to carry out searches in the localities mentioned by the three informants to verify if *C. seychellensis* still occurs there.

Conclusion

In view of the scanty information available on the biology and ecology of *C. seychellensis*, it is necessary to carry out further studies on this rare and probably threatened species. The observations reported above tend to suggest that its continued if precarious presence on Mahé, but its current status on Silhouette is unclear

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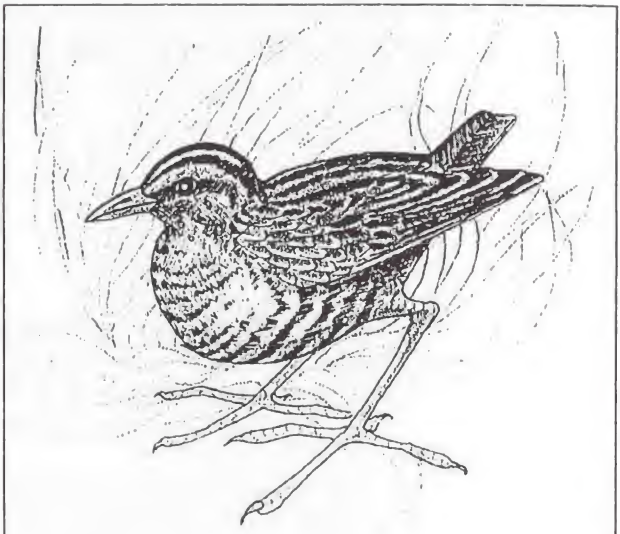
Birdwatch

News and views from the Seychelles Bird Group.



Cornerake on Aride island

The Nature Protection Trust of Seychelles produces two regular publications; *Birdwatch* and *Phelsuma*. These can be obtained from the NPTS (PO Box 207, Victoria, Mahé, SEYCHELLES at the follwing subscription rates:

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